THE

ELECTRICAL REVIEW.

VOL. LXIV. JUNE 11, 1909. No. 1,646

ELECTRICAL REVIEW.

Vol. LXIV.] CONTENTS: June 11, 1909. [No. 1,646.

	Page
Electrical Accidents in 1908	949
The N.E.M.A	950
Municipal Trading.—The E.C.A. *v* the I.M.E.A.	950
Phœnix Fire Office Rules	951
One Cause of Unemployment	951
Imperial Intercommunication	951
The Electrical Industry and the "Daily Express"	952
Fittings and their Method of Attachment (*illus.*)	953
Electricity in the Home	954
The Distribution Department	955
Correspondence:—	
Electrical Machinery Exports	957
Electricity in Cornish Mines	957
Telephone Agreements	957
Lightning Phenomena	957
A Correction	958
The Electrical Industry and Tariff Reform	958
Specifying for Sound Workmanship	958
Mining Switchgear	958
E.M.F. in a Dead Underground Cable	959
Engineer's Dept. *v.* Accountant's Dept.	959
Electrical Accidents in 1908	960
Our Legal Query Column	961
Reviews	961
Business Notes	963
Notes	971
City Notes	973
Market Quotations	976
Stocks and Shares	976
Share List of Electrical Companies	977
Seventh International Congress of Applied Chemistry (*concluded*)	979
Our National Industrial Weaknesses (*concluded*)	981
A New Preston Showroom (*illus.*)	983
Trade Statistics of Denmark for 1907	984
Electrical Equipment in the "Times" Press Room (*illus.*)	985
Proceedings of Institutions:—	
Comparisons between Steam, Gas and Oil Engines (*illus.*)	985
Electricity Works and Refuse Destructors	986
Foreign and Colonial Tariffs on Electrical Goods	988
New Patents Applied For, 1909	988
Published Specifications	988
Contractors' Column	Advertisement pages 56, 58 and 60

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 983; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

READING CASES, to hold from One to Twenty-six Numbers until the volume is complete for Binding, can be had from the Publishers, Price 6s., or Free by Post (in Great Britain), 6s. 6d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOIVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S).

1909 EDITION

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

ELECTRICAL ACCIDENTS IN 1908.

Of all the official documents annually issued relating to the electrical engineering industry, there is surely none so full of human interest as the Report of Mr. G. Scott Ram, the Electrical Inspector to the Home Office Department. Other reports relate to matters of a technical, commercial or industrial nature; this alone appeals directly to every person engaged in the production or utilisation of electrical energy, in power station or workshop, seeing that it treats of matters directly affecting his personal safety—even his very life. It must always be borne in mind that, since the general adoption of voltages of 200 volts and over for electricity supply, almost every lighting and power circuit possesses the property of becoming, under suitable conditions, a death-trap; there are, in fact, two instances recorded in the present report in which fatalities occurred on systems working at or about 200 volts—one of these was due to a fall following a shock, but it was none the less fatal—and last year there were four cases of a similar character. We do not wish to imply that electrical circuits are one whit more dangerous than gas installations; this is by no means the case, for numerous fatalities have occurred through the use of gas, not only in premises inspected under the Factory Acts, but also in private houses, and we cannot recall a single instance in which an ordinary consumer of electricity has received a fatal shock in his own house. Electricity has the advantage, also, that it cannot escape into the atmosphere, whereas escaping gas may attack and slay the sleeper in his bed. We desire, however, to impress upon our readers the necessity of exercising caution in handling conductors which may possibly be "live," even at a moderate voltage, and the great importance of taking every conceivable precaution against the possible infliction of a fatal shock upon an innocent and unsuspecting victim. It is not sufficient to provide safeguards only for the unskilled. Mr. Ram's returns show clearly, where comparison is possible, that far more accidents have occurred to skilled than to unskilled persons. This result may be due to the fact that the majority of those engaged in work upon, or in the neighbourhood of, charged conductors, are of the former class, but, nevertheless, the accidents occur; probably many of them are the result of excessive confidence born of familiarity with the danger, and leading to carelessness or rash neglect of the precautions that ought always to be observed in such surroundings.

We note with regret that although in many respects the Report for 1908 closely parallels that for the previous year, there is a very marked increase in the number of electrical accidents in generating stations and sub-stations—approximately 30 per cent.; the number of fatal accidents in factories and workshops has increased in a still greater ratio, though, happily, the number of non-fatal accidents shows a fall of 14 per cent. We trust that the new

Regulations drawn up by the Home Office, based upon the wide experience gained by Mr. Ram, debated at great length last year and amended by a committee of experts, and finally settled by the special Commissioner, Mr. James Swinburne, will prove effective in reducing the number of accidents to a minimum. The Regulations come into force in factories and workshops on July 1st next, and in electrical stations on January 1st, 1910. Touching the latter, it is regrettable to learn that, even now, electrical stations are frequently designed apparently without the slightest regard for the safety of the attendants; some of the examples cited in the report form startling reading. Fortunately, the Inspector believes that nearly all the cases of bad and dangerous work and conditions that he has described and commented upon in his annual reports are now covered by the Regulations, and we may confidently look forward to more cheerful and reassuring reports in future years.

The N.E.M.A.

We have received from Mr. F. B. O. Hawes, who has lately taken up the reins of secretaryship of the National Electrical Manufacturers' Association, a pamphlet relating to the objects, past and present achievements, and committee *personnel* of that organisation, from which we gather that a very worthy effort is being made to arouse an increased interest in the Association, and bring into membership firms who, so far, for reasons of their own, have thought it desirable to hold aloof. Whatever the past or current opinion concerning the N.E.M.A., it will be as well for all firms in the electrical industry who read this pamphlet to bear in mind that a measure of reorganisation has recently been effected, and we have authority for saying that very shortly some of the larger manufacturing firms, for whose absence the Association has too long been conspicuous, will be included in the membership rolls. Two such firms have already been added during the past year, and their representatives, Mr. D. N. Dunlop and Mr. B. Longbottom, have seats on the committee. Everybody who has the interests of the electrical industry at heart will join with us in wishing Mr. Hawes complete success in his efforts to so enlarge the Association as to render it thoroughly representative of all departments of the industry, including both heavy electrical machinery and what are generally understood as electrical supplies.

After all that has passed this will not be accomplished in a day, but it is an effort well worth trying, for the electrical manufacturers and traders of this country, as we have often pointed out, need an association, the membership of which can give them the manifold advantages that ensue from co-ordinate effort.

What has been achieved in the past in such matters as railway rates, customs classification, specifications, fire insurance, exhibitions, Christmas boxes and other trade abuses, the establishment of a benevolent fund, and in some other ways, has been related from time to time in our pages, but no doubt a great deal more might be done for the good of several times the number of firms, with just the same effort, if their support were forthcoming. Membership in the Association does not involve objectionable interference with the individual policy or business of any firm, while it may conduce to the good of all. Business men will at once appreciate how advantageous it will be to them to be put upon the alert from headquarters against such costly annoyances as long firm frauds, from which the electrical industry is no freer than any other, while the status bureau enables any member to promptly obtain, by means of arrangements existing with the British Traders' Association, whose offices are in the same building as those of the N.E.M.A., reliable and up-to-date information concerning the financial status of any firm, and overdue accounts can also be collected under the same arrangement. We single out these as examples of advantages that accrue from membership as the Association stands to-day.

Since our last reference to the Association appeared, Mr. Bevis has relinquished his chairmanship of the committee, owing to the change in his business arrangements, but as an associate member he has been elected to a seat on the committee. Mr. C. S. Northcote, who was formerly organising secretary, is no longer acting in that capacity, and is doubtless busily engaging his attention with numberless other activities. Furthermore, the "foreign element" on the committee is not nearly so large as seems to be generally supposed. We commend the Association and its pamphlet to the consideration of manufacturers, in the hope that they will weigh it purely and simply as a business proposition, and decide for themselves whether it is not worth while putting their shoulder to this wheel instead of awaiting the arrival of another organisation which may never turn up.

Municipal Trading. The E.C.A. v. the I.M.E.A.

We understand that we were a little premature in congratulating the Electrical Contractors' Association on their well-earned victory against municipal trading. We confess that we had overlooked the possibility of traitors being within the camp. It had, in fact, never occurred to us that the members of the I.M.E.A. were favourably disposed towards municipal electric contracting, for we were under the impression that this was carried on in most cases in spite of their own views and inclinations. We have been much surprised, therefore, to learn that the I.M.E.A. is offering a most strenuous opposition to the Avebury amendments introduced into the Electric Lighting Acts Amendments Bill by the House of Lords. The *Electrical Contractor* and the *Ironmongers' Chronicle and the Hardwareman* are both up in arms against the action of the I.M.E.A., who are bringing to bear upon Members of Parliament all the pressure they possibly can with a view to the deletion of the Avebury clauses.

We have no particular affection for the ironmonger-electrician, although there is no reason at all why an ironmonger should not add an electrical department to his business, just as electrical contractors may themselves run other side lines. In the interests of the electrical industry, electrical contracting must be carried out only by men who have been properly trained to their work, and we must leave it to the Electrical Contractors' Association to fight the jerry wireman under whatever name he may trade. It has been contended in some quarters that the wiring work done by municipalities is of a better quality than that carried out by electrical contractors: we have, however, formed the opinion that, whilst municipal engineers expect the work of wiring contractors to be carried out in accordance with certain codes of rules, the work which they themselves put up on consumers' premises rarely complies with these requirements. But this is not the point at issue; the whole question is the unfair competition between municipalities and private tradesmen. It is absurd to argue that the electrical contractor's interest in the matter amounts to the few shillings a year which he pays in rates as subsidy to the municipality's wiring department. If this were all, the matter would not be worth discussing. This contribution, not a voluntary but an enforced one, goes towards maintaining an unfair competitor who is robbing him of his livelihood. We still hope to be able to congratulate the Electrical Contractors' Association on having commanded complete success; meanwhile, we congratulate them upon having deserved it.

Phœnix Fire Office Rules.

We have received from the Phœnix Fire Office the 38th edition of their Rules for Electrical Installations. The Phœnix is one of the very few companies, if it is not in fact the only one, which prefers to issue its own set of rules rather than to adopt those issued by the Institution of Electrical Engineers. The present edition of the rules differs very considerably from the previous editions, the rules having, in fact, been entirely re-written and brought into line with modern practice. To indicate all the various alterations which have been made would necessitate referring to almost every rule, and we must content ourselves by saying that the present rules aim rather at specifying the conditions which must be observed than at entering into minute details as to how the work should be carried out. It was a standing complaint against the old rules that to practically every rule there was an exception, making it very difficult indeed to know what would be passed by the company's inspectors. This characteristic feature has been removed, and those now issued are as they stand very much more serviceable than their predecessors. In view of the many attempts to introduce cheaper systems of wiring, it is interesting to note that the framer of the present edition of the rules is not unfavourably disposed towards surface systems of wiring both with flexible and metal cased systems. It is interesting to note also that motor starters must be provided with automatic no-voltage release, a requirement which it will be remembered was eliminated from the Home Office regulations. An automatic overload release is also asked for, but we are not altogether satisfied that this is a desirable feature in every case, and as the word "should" instead of "must" is used in this connection, no doubt a little latitude will be allowed.

The rules now occupy 38 pages as against 60 for the old rules, so it is obvious that much unnecessary matter has been scrapped. Mr. Russell is to be congratulated on having entirely redrafted the rules instead of attempting to bring the old ones up to date, an almost impossible task. He has done his work well, and there is little doubt that the new Phœnix rules will soon become recognised by all sections of the industry as a standard set of requirements for good work.

One Cause of Unemployment.

While the voice of the unemployed is not now quite so loud as it was in the winter months, the causes of this evil are constantly at work, and are always manifest to the observer of industrial life. Recent legislation in the supposed interest of the working man is not the least important of these causes.

The Workmen's Compensation Act was wide enough in its extent, even at first sight; but its practical operation shows that it imposes a most onerous burden on the employer, and this must have its inevitable reaction on the labour market. Let us instance one very recent case. A man employed at a pit was guilty of a deliberate breach of the rules, whereby he sustained injury. The Act makes the employer liable, unless the workman is guilty of serious and wilful misconduct; but even this defence does not avail the employer if the resulting injury is serious and permanent. In the case in question, doctors were found who said that the injury was of this nature, and the consequence was that the unfortunate employer had to pay the compensation.

The more serious the consequences of deliberate disobedience the more likely is the employer to be made responsible. To avoid liabilities of this kind the employer must insure; and the insurance companies, realising the full extent of the liabilities to which they are exposed, are putting up premiums to an extraordinary extent. Let us see how all this reacts on the question of employment. According to a recent article in *Engineering*, an attempt at a balance of risks is expected in some cases by paying off the workmen who are not, in the estimation of the insurers, first-class lives, such as represent the minimum risk of death or disablement in the course of their employment.

It is stated on the same authority that in a big shipbuilding firm, who are their own insurers, it is now the rule to take on no new workman who is over 40, and to re-engage no workman whose age is over 50, after he has been paid off in time of slackness. Since this has been adopted as a policy of economy by employers who are their own insurers, it may be anticipated that insurance companies will continue to impose the most strict conditions. Some insurance companies have gone upon the principle of paying every claim; but the prevalence and increasing popularity of malingering has naturally rendered them more cautious. Again, the decisions of the Courts as to what is death or injury "by accident" are so favourable to the workman that employers or insurance companies acting for them find it necessary to protect themselves. For instance, it was recently held that a weak and emaciated artisan who was working his way home in a stokehold, and met his death through heat apoplexy, was the victim of an accident. These are the results of a few years' working of the Act. What will be the condition of things 10 years hence?

We should not be surprised to find the workmen of that period clamouring for the right to contract out of the Compensation Act, in order to procure employment.

Imperial Intercommunication.

On Monday last the Imperial Press Conference was occupied with the question of providing cheap communication by cable between the various portions of the world-wide British Empire, with a view to facilitating the interchange of news, and thereby bringing the Dominions into closer and more intimate relationship with each other and with the Mother Country. This admirable object is one which we regard with the warmest sympathy; and as we have frequently expressed our views on the subject, we need not further dwell upon this aspect of the question. The Conference, we are pleased to say, dealt with the subject for the most part in a moderate and rational way. The Postmaster-General (Mr. Sydney Buxton) put the matter in a nutshell when he said that it was really a business matter of pounds, shillings and pence. Whatever means be adopted—subsidies to the companies, acquisition of the existing cables, or the laying of new State-owned cables—that is the basis upon which the question must necessarily be approached.

The Postmaster-General thought that the British Post Office had treated the Press perhaps too liberally, for it carried their "goods" at a loss; but pecuniary loss will be almost unavoidable if material assistance is to be given to intercommunication by cable, though in other ways the loss may be abundantly recouped. He stated that he had already sounded the cable companies on the subject, and found that they were willing to consider favourably a reduction to, say, 1s. or 6d. a word, if they were assured that a considerable additional amount of matter would be transmitted; this cautious attitude is a very proper one for the directors of commercial undertakings to adopt—they have the interests of their shareholders to consider, and as Mr. Buxton pointed out, they have done good service to the Empire at large. No proposition which involves injury to their enormous investments, or injustice to their members, is likely to receive the sanction of the British Parliament and people. It is essential, therefore, that the subject be discussed upon commercial lines, with due regard to the rights of all parties.

One of the Canadian delegates advocated the laying of a State-owned Atlantic cable, and State-owned lines across Canada, to complete the connection with the Pacific cable; this is a proposition which has been repeatedly discussed, and we have little doubt that it will eventually be carried into effect. The question was, however, deferred; the Conference adopted a resolution declaring that cheapened and improved telegraphic facilities between the various parts of the Empire were a paramount necessity, and appointed a fully representative committee to consider the matter and report to the Conference on the 25th inst. The report will be awaited with interest. The submarine cables are the only physical links that bind together the scattered members of our Empire—which, without them, could not exist as such; it is obviously of the first importance that these frail bonds shall be utilised to the utmost possible extent, and the fact that they are idle during some hours of each day is not only discreditable to our common sense, but also proof that much more can be done with their aid than at present, at a comparatively small cost.

THE ELECTRICAL INDUSTRY AND THE "DAILY EXPRESS."

The *Daily Express* is very cross; no wonder! But it should not rail at us, it has only itself to blame. "Wrong again," it cries. "The Electrical Review says the Tariff Commission did not recommend any duty on electrical goods .... This is the grossest misrepresentation of the real facts .... The Commissioners did not recommend any duties on imported electrical goods." This is just what we said, isn't it? The *Express* adds "the simple reason is that they have made no recommendation of the kind with regard to any industry up to the present." Good, we congratulate the Commissioners on so accurately estimating the value of the evidence tendered to them.

The *Express*, however, is not satisfied, as we pointed out in our leader on the subject. In *its* opinion "the great bulk of the evidence favoured the imposition of duties," hence it throws over its Tariff Commission and conducts an inquiry on its own lines.

If you want a certain verdict, it is safest to be the judge as well as the prosecutor. As judge, you can rule out any evidence which does not strengthen your case as prosecutor. We have already shown how the *Express* conducted its inquiry, and how it based its extraordinary conclusions on what, according to its own showing, formed the opinions of less than 1 per cent of the 2,000 manufacturers engaged in the electrical industry. We show below how such opinions are *edited* in the *Express* office to suit the tastes of its readers.

Our only reason for now returning to the matter is the necessity for putting on record the true facts relating to a letter which our daily contemporary published in the hope of discrediting our analysis of its figures.

The East Anglian Engineering Co., Ltd., which the *Express* Inquiry expert describes as "a prominent firm of electrical machinery manufacturers" (how "prominent" may be inferred from credible information received from the locality that the total number of their employés is from 15 to 20), are reported to have stated in their reply—

> We have often taxed the Electrical Review, as one of the leading electrical papers, for not having supported the electrical manufacturing industry (whence it derives its support) in this vital matter, but they claim that the bulk of their clients are opposed to Tariff Reform. But the editors would not accept our suggestion to put it to a test. We are pleased to assist you in doing so.

Whatever any of our friends, opponents or supporters, may have to say regarding us, they cannot charge the Electrical Review with hyper-sensitiveness. From time to time many things have been said by irresponsible individuals, the refutation of which we have not thought worth while, for we believe that our principles are known and understood by the electrical fraternity of this and other countries. As we have often taken up the cudgels ourselves, we are not likely to resent others doing likewise, legitimately and fairly. But when we read the foregoing letter, we thought some things of which we need not write, and as we are therein charged with designedly supporting the interests of one section of the industry, and deliberately neglecting those of another, we thought a little inquiry on our own was warranted. We therefore addressed the firm, whose testimony was of such importance to the *Express*, in the following terms:—

May 28th, 1909.

> Dear Sirs.—We observe that the *Daily Express* in its issue of May 27th publishes a letter from you in which you say we claim that the bulk of our clients are opposed to Tariff Reform.
>
> Will you be so good as to furnish us with information, either published or by correspondence, which justifies this assertion on your part?
>
> Yours truly,
> The Editors.
>
> The East Anglian Engineering Co.,
> Stowmarket.

We print the reply below in all its unadulterated simplicity without any editing whatsoever.

June 2nd, 1909.

"Daily Express" Comments.

> The Editors, Electrical Review.
>
> Dear Sirs.—We must apologise for not having replied more promptly to yours of the 28th ult., but we have been closed for the Whitsun holidays until this morning.
>
> The assurance was made in a most positive manner to us, on both accounts, by your representative when last calling upon us, and about the time we filled in the *Daily Express* canvass, but we would wish to say that our remarks were added as a footnote, and we had no intention that they would be used for publication or we would have asked you to have confirmed same, although we had no doubt, whatever, in our own minds, considering your general attitude, that you would have done so without hesitation.
>
> The question was introduced by the writer to your representative by taking the Electrical Review to task for not having supported the movement, or at least for not having remained neutral, seeing that the electrical manufacturing industry generally was, no doubt, strongly in favour of the Tariff Reform movement, but your representative assured the writer in a most decided manner that the bulk of your advertisers were opposed to the movement. The writer, not feeling convinced, suggested that the editors might put it to the test by canvass, but your representative assured us that there was no need, and, moreover, not diplomatic. The writer then inquired whether he thought the editors would allow us to put it to the test, but your representative felt convinced you would not, for the same reasons as before stated.
>
> Our footnote remarks have naturally assumed far more importance than we intended to convey since they have been made public property.
>
> Yours faithfully,
> H. W. Wilson,
> *Managing Director,*
> *For the East Anglian Engineering Co., Ltd.*
>
> P.S.—Although what the *Daily Express* said was substantially correct, I am not quite sure whether word for word it was an exact duplicate of my footnote; I am inclined to think I expressed myself rather differently.—H. W. W.

Whether the East Anglian Co.'s testimony, as now seen in its true light, is of any value to the *Express* in its crusade, we will not stay to discuss, but we desire to say that no representative of the Review's editorial department, nor anyone in any way responsible for our editorial policy, has ever been to the Stowmarket Works, or met Mr. Wilson. The conversation alluded to was a casual one between that gentleman and one of our advertisement representatives who had then only recently joined our staff, and who flatly denies that he ever quoted the opinions of our advertisers as the reason for our attitude on the subject of Tariff Reform. He did not know the views of our advertisers, nor do we ourselves know anything about the proportions of our supporters who are and are not believers in the new doctrine. If Mr. Wilson needs our consent in order that he himself may institute an inquiry, we give it most readily; we did not know, until he wrote, that our permission was necessary!

We may inform Mr. Wilson that, whether we are right or whether we may be wrong in our views on the general question and its probable effects on the electrical industry, we do not say Yea or Nay at the bidding of any section of our advertisers. What would be their opinion of us if we did so? We have our own views, and are entitled to express them. Our "Correspondence" columns have been open to both sides—they always are—and they have contained the views of advocates of both the existing and the new policies. The hospitality of our columns was extended to Mr. Wilson himself on several occasions, as he well knows.

It has always been gratifying to us that, whenever we felt it to be our duty to weigh up the pros and cons of any matter in which different interests came into conflict, the Electrical Review continued to receive the support of all sections alike. We regarded this as an evidence of the fair-mindedness of our electrical *confrères* and of their recognition of the necessity that has always existed for impartial criticism of any matter of interest to electrical engineers and their profession and industry. We have every reason for believing that the same, or an even greater, measure of support will be given to us in the future, though we may sometimes feel compelled to differ in opinions. The well-being of the electrical industry has always been our chief concern, and wherever we find it possible to advance the interests of the electrical trade, we make it our duty to take prompt and thorough steps to effectively do so. On this point we need not enlarge at this late date.

The Electrical Review never has allowed, and never will allow, itself to be driven into saying what it does not feel, nor to be manacled, shackled or racked into suppressing its opinions in regard to the electrical profession and industry. The peculiar thing about the mud-slinging of the *Express* is that it has arisen because we analysed its figures in such a way that it cannot reply to them, and can

only get others to do so with a string of very debatable generalisations. It was not a question of Free Trade or Tariff Reform, but purely and simply of the accuracy or otherwise of certain figures, and the unfairness of assuming that the opinion of a few firms was representative of the majority. Surely this was a quite legitimate thing for us to critically handle!

FITTINGS AND THEIR METHOD OF ATTACHMENT.

By W. A. TOPPIN, A.M.I.E.E.

It is essential for the safe and efficient installation of electric light in houses and public buildings that the manufacturer of fittings should work in harmony with and appreciate the difficulties of the wiring contractor. A large number of the fittings that one sees are undoubtedly very artistic in outward design, but owing to the small and poorly-insulated wires that are of necessity used for wiring them and the lack of proper provision for attaching them to the wiring of the building, they are the weakest points of an installation. Short-circuits and leakages, resulting in frequent interruptions to the lighting of a building, are the consequences of the fittings designer not appreciating the wireman's difficulties in attaching fittings. A great deal of time is frequently wasted by wiremen in the endeavour to thread

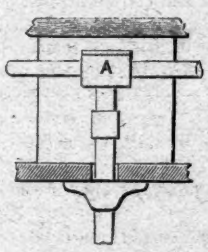


Fig. 1.

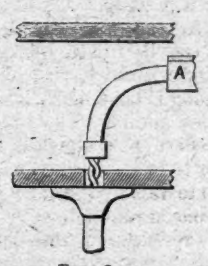


Fig. 2.

the smallest flexible obtainable through elaborate fittings, the holes passing through them being altogether too small for any well-insulated wire to be used. The writer proposes to discuss the different methods of attachment and the points that should be aimed at to get the best results.

As flexible wire is most frequently used in fittings, let us see what the I.E.E. Wiring Rules, 1907, have to say on the subject: "Flexible wires must not be used in any position out of sight, except where passing directly through walls, when they must be protected by incombustible water-tight conduits. They must not pass through floors. The connection between flexibles and hard wires may only be effected by means of screw-down terminals in junction boxes or ceiling roses, and where flexibles from fittings must pass into a ceiling they must be enclosed in conduits up to a metal junction box." We see that the once popular, and, perhaps, even now frequently used method of jointing the flexible to the ordinary wiring, is forbidden. Unprotected flexible wire in positions out of sight is also forbidden, and with good reason, as it is liable to injury from mice, rats, or the "deafening" used between the floor boards and ceilings in better class property.

Let us consider some of the different methods used for the connecting-up of fittings as illustrated in the accompanying diagrams:—

In fig. 1 is shown the top part of a fitting which is supplied with a screwed tube, connected by means of a coupling to the bottom outlet of a junction box A. The fittings wire is completely protected throughout its whole length, being brought up into the box A and there connected to the ordinary wire by means of a special porcelain fitting. Many contractors would doubtless allow their men to joint the flexible straight to the wire, dispensing with terminals, in defiance of the I.E.E. rules. In fig. 2 the same method of attachment is adopted, excepting that in this case the fitting has not been provided with a screwed connection, and, therefore, the tube coming from the box A is brought down as close to the base-plate of the fitting as possible, and the end bushed.

It sometimes happens that the position of a fitting is changed two or three times after the wiring has been finished, and the method shown in fig. 3 is frequently the result.

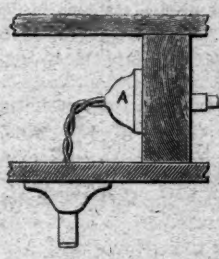


Fig. 3.

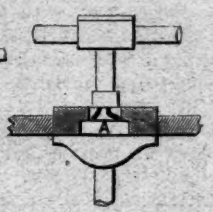


Fig. 4.

Contractors are also liable to use this method when the wires are run in casing. The flexible is brought into a ceiling rose A which is fixed to the side of a floor joist. The I.E.E. and most supply authorities' rules do not permit this to be done. Fig. 4 shows a very satisfactory method adopted by the better class contractor, which complies with all the requirements. A porcelain fitting is let flush into the plaster and the tubing brought down to this. The flexible is attached to the terminals of this special fitting.

A disadvantage of method 4 is that it is necessary to make a rather larger hole in the ceiling. This can be avoided by adopting the arrangement shown in fig. 5, in which an ordinary ceiling rose A' is fixed in a special block to which the fitting is also attached. A variation on this arrangement is sometimes made by fixing the ceiling rose to an ordinary block and adopting a fitting with a deeply recessed top plate, as shown in fig. 6, which completely encloses the ceiling rose. Either of these arrangements is excellent from an electrical standpoint, but may be objected to owing to the heavy appearance of the top of the fitting. In order to avoid the necessity of fixing a block on the ceiling, and also to reduce the size of the top plate, the method shown in fig. 7 might well be adopted. In this case a wall socket is fixed flush in the ceiling and the fitting attached to the socket. To carry this idea still further the fittings manufacturers could easily fix the head of a wall socket into the top plate of their fittings and connect up the wiring themselves. The wiring contractor would then wire up to and fix the socket in the ceiling, push the pins into the holes and screw the fitting on to the concealed block. The

Fig. 5.

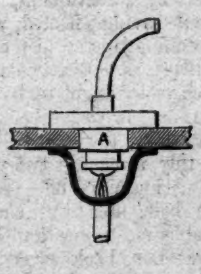


Fig. 6.

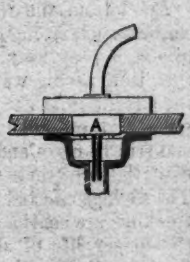


Fig. 7.

wall sockets employed could be fitted with three or four pins if necessary, in order to allow of the lamps on a fitting being controlled independently of one another.

It frequently happens that the wiring contractor's responsibility ends with wiring up to the ceiling points, the owner of the property buying the fittings direct, and perhaps asking the contractor to fix them. Under these circumstances, if anything goes wrong, either at the first test of the installation, or afterwards, the contractor can avoid the blame by asserting that the fault is in the fittings and is not due to defective wiring. If any of the methods shown in figs. 4, 5, 6 or 7 have been used, the fittings can easily be

entirely removed without the raising of floorboards and the defect can at once be found. Another argument in favour of the use of the last four methods, and especially of the last two, applies when premises are free wired by the supply authority. The occupier of the premises, as a rule, pays a rental for the wiring, but the fittings are his own property. It is essential, therefore, that in the event of his leaving, the fittings should be easily detachable.

The attachment of wall brackets causes probably even greater trouble than fittings. Whilst none of the diagrams deal directly with brackets, the methods shown in figs. 4, 6 and 7 would answer admirably. The writer is of the opinion that the subject dealt with is the point most frequently scamped in wiring installations. Sometimes the fault is due to the design of the fitting; at other times it is the fault of the contractor. A large number of wiremen are, no doubt, rather ignorant of the I.E.E. Wiring Rules, and steps might be taken to improve matters in this direction. Others again are tempted, either for the sake of speed, or through indifference, to scamp this part of their work, as it is all concealed. If electroliers and brackets were fitted with plug attachments as shown in the last two diagrams, and the owner of the installation purchased the fittings direct, it would be a very simple matter to have the wiring tested first of all, and then the fittings put and screwed in position, and another test made including everything. Thus the owner of the installation would receive more satisfaction, and the fittings manufacturer and wiring contractor would each get justice. The wiring contractor, no doubt, would always prefer to supply the fittings himself, but only the large contractor can afford a show room containing a sufficient selection of fittings to please his clients.

ELECTRICITY IN THE HOME.

By "MAUD."

Having had a considerable experience with both gas and electricity for lighting and heating purposes in the home, I hope that this article will prove helpful and interesting to those contemplating the use of this most useful commodity in the home. I will take for comparison an 8-roomed house, all the rooms of which are lighted electrically.

The dining room has just a single lamp with a white-lined shade over the table, the size of the lamp being 50 c.p.; this I find an excellent light, and it gives 16½ hours' light for 3d., as against incandescent gas, for the same amount of light, 3¾d. per 16½ hours, to say nothing of the gas wasted by the by-pass jet which is on continually.

Apart from the direct saving effected, we must take into consideration spring cleaning times; with electric light, wall papers last at least twice as long as when gas is used, and this is a saving which really ought to be credited against the electric light accounts. It costs about 30s. to paper a room, and on the basis that the paper will last four years, and still be clean and tidy, as against two years when gas is used, this represents a saving of 7s. 6d. per room per annum. The savings effected by being able to use curtains about twice the time are considerable, not to mention the resulting from the longer life of draperies, book covers, plants and cut flowers. On the last two items I have effected savings of at least 6d. per week.

The drawing room is lighted by two 50-c.p. lamps controlled by two switches, as I find one light sufficient, except when entertaining. These two lamps, when on, give a splendid light, and to some may seem excessive, but the beautiful effect given by the two lamps with nice shades outweighs the slight amount of seeming wastefulness, and one feels justified at times in indulging in a little extravagance for beauty's sake. I have also fixed in the drawing room an electric radiator of the non-luminous type; this takes 1 unit per hour when full on, and when the room is sufficiently heated it can be regulated to one or two-thirds heat to prevent overheating of the room. This radiator, I find, is a great saving over a coal or gas fire, as it costs full on for 12 hours per day 1s., as against a coal fire for the same time costing 9½d., and a gas fire 1s. 6d. Though the coal fire, on the face of it, costs only 9½d. per day, one must add to the cost of the fuel the extra cost of cleaning, &c., which is not required in the case of the electric radiator.

An electric kettle for this room for afternoon tea is a great boon; this can be kept boiling on the table, and should be attached to a special plug in the wall. Tea can be made at the very low cost of one-tenth of a penny per quart of water required. An electric hot-plate to keep muffins, &c., warm is really a necessity, owing to its convenience, and only costs one-fifteenth of a penny per tea-time. This hot-plate can be used on the breakfast and dinner table, where its uses are numerous, and if used at all meals of the day it will only cost about one-third of a penny per day. This is extremely small compared with the convenience of not requiring the maid every few minutes.

When the sultry summer weather comes, a portable electric fan is almost as good as a visit to the seaside, as it can be set just in the best position to disperse its cooling breezes, and it will make the summer day's work less fatiguing and irksome; all this for a cost of current not exceeding that of a 16-c.p. lamp.

The lighting in the kitchen should be not more than 16 c.p., with 8 c.p. in the scullery and back passage. An electric iron is far ahead of the ordinary irons for the kitchen, to heat which one must either keep a large fire on a hot summer day, or run up a large gas bill if a gas iron is used, the gas thus used being nearly equal to the amount of gas required to light the house. An electric iron can be purchased for about 21s., and only costs about ¼d. per hour to use; it is scrupulously clean, and can be kept at a beautifully even temperature, so that laces, blouses, and all delicate articles can be ironed quite easily without fear of burning them, and without having to wait to heat up the iron; thus the ironing is done much more quickly and cheaply than by any other means. The iron is very simple to fix, as it only needs a plug attached to the wall, which can also be used for the many electric contrivances now on the market, which are rapidly becoming popular, as they are helping to make home duties lighter.

My experience is that great care should be taken to economise the use of electric light in the kitchen and all servants' quarters, as in the majority of cases this is where the greater part of the light is used.

The hall is lighted by a single 8-c.p. lamp, fixed in the old gas lantern, which saves buying a new fitting. This lamp can be switched off, except when visitors are in the house, the maid simply switching on the light to answer the door or lay meals, and cutting it off again when not wanted. This effects a great saving over gas, which is generally left burning low during all dark hours in the hall, and it is most annoying on a windy evening when one answers the door, that owing to the rush of air the gas is nearly extinguished; the electric light enables one to see quite clearly desirable and undesirable visitors, and goes far to give confidence when the latter pay a call.

The landing is lighted by an 8-c.p. lamp nicely shaded, and the bathroom by an 8-c.p. lamp on a universal bracket, which makes shaving a luxury instead of a dreaded bore, such as it becomes to the business man who shaves in the evening instead of the cold winter mornings. A shaving pot in the lavatory is a boon, but the electric kettle can be used to heat the water; the latter saves purchasing the shaving pot, and enables one to have a very plentiful supply of water for this most delicate, and generally abhorred, item of the day's routine.

The bedrooms take a 16-c.p. each, and the lamps should be fitted with neat shades. Where it is desired to have a light all night, a turn-down lamp should be used; this type of lamp gives 16 c.p. full on, and 1 to 2 c.p. when turned down. A small portable radiator should most certainly be used in the bedrooms, and it should be so arranged that it can be moved from room to room as required. The saving over a coal fire is considerable; any mistress knows the time it takes to clean after a fire, and even if a gas fire is used in the bedroom, the unpleasant odour arising from this type of fire, coupled with the dirt it creates, is especially

distasteful to invalids. An electric radiator makes no smell and requires no further cleaning, beyond dusting.

In this article I have not dealt with the many useful apparatus for the bedroom, such, for instance, as a milk boiler for baby, curling irons, bedwarmer, &c., including an electric battery for rheumatism or neuralgia; but it will be found that all these help to make life more enjoyable, and tend to the securing of better health.

I find that the lighting, as outlined in this brief description of electricity in the home, does not cost me more than £3 15s. per annum, and when account is taken of the numerous savings which it effects, it cannot really be said to cost more than half this amount. I shall be very pleased to describe further to any lady anything that I have not made quite clear in this description of the application of the most useful of Nature's forces ever known to mankind.

THE DISTRIBUTION DEPARTMENT.

By H. F. J. THOMPSON, Chief Assistant Engineer, Battersea Borough Council Electricity Department.

Some years ago the distribution department of a number of electricity supply undertakings consisted of a few men, headed by a junior official. Such a staff was certainly inadequate to deal with the work.

The competition of gas has fortunately changed that state of affairs, and it is now fully recognised that it is useless to give all one's attention to the generating department and leave the distribution to junior officials.

It is surely quite as necessary to study economy and efficiency outside as it is inside the station, and therefore the distribution should be under the supervision of a responsible official, who recognises the position of his department as an important link between the station and the consumer.

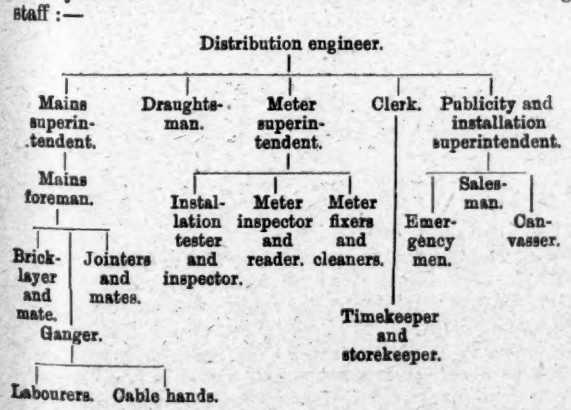
When the station has done its best in producing the energy at a low figure, then the distribution engineer should see that as little as possible is lost in delivering it to the consumer, and if the latter has any complaints regarding the supply, he should receive prompt and courteous attention.

It is well to remember that an old consumer retained is probably worth several new ones, for the loss provides food for gas companies' literature, and also a new consumer requires new connections to the mains, with their attendant costs.

With the use of higher pressures, the field of supply companies has now increased greatly, and in some cases the capital expended on the transmission and distribution system is as much as double the cost of the generating station; therefore a few hints on the organisation and management of this oft-neglected department should not be out of place.

Staff.

A system of moderate size should warrant the following staff:—



If it is found to be necessary to cut down the suggested staff to suit a smaller undertaking care should be exercised, and in no case should the Meter Department suffer, as it is certainly a very important branch; for, after all, the financial result depends to a great extent on the meters, and if they are neglected the units unaccounted for are sure to creep up. The following duties should be allotted to the various officials:—

Distribution Engineer. — General management of the department; dealing with correspondence and distributing it amongst the staff; detailing duties to each official and receiving daily reports as to progress; design of general system of transmission and distribution; interviewing possible large consumers and conducting negotiations; settling important disputes regarding accounts or complaints; preparation of specifications and supervising all important works.

Mains Superintendent.—Distributing the work allotted to him amongst the jointers, &c., and supervising them; testing mains and locating faults and keeping logs of same; obtaining sketches and details as to the position, &c., of all cables and boxes and delivering them to draughtsman for entry on plans; periodical inspection of sub-stations, feeder pillars and important portions of the system and keeping records of such visits; engagement of skilled labour; reading of loads on network and pressure at various points and keeping log of same; keeping extension and service book to show at once how each job stands; details of reinstatement of trenches.

Mains Foreman.—Seeing that all men get away quickly to their work in the mornings; supervising closely all work and reporting each evening to mains superintendent; engaging unskilled labour; periodical inspection of all disconnecting boxes, &c.

Draughtsman.—Preparing plans to accompany statutory notices, &c., and rough plans for mains superintendent; entering details of works on plans as supplied by mains superintendent; plans of proposed new mains and estimates for same.

Meter Department.

Meter Superintendent.—Testing and calibration of all meters and instruments; testing and reporting on sample apparatus; keeping card record of meters; detailing work and receiving daily reports from men in his department; monthly inspection of meter reading cards and making out list of suspected faulty meters.

Installation Tester and Inspector.—Inspecting installations during progress and testing and connecting them on completion; attending to all complaints of bad light, &c., testing pressure on consumers' premises and keeping records of same.

Meter Inspectors and Readers.—Weekly (large consumers) monthly and quarterly meter readings; attending to monthly list of queried meters, and making rough tests of same on consumers' premises.

Meter Fixers and Cleaners.—Fixing meters and other registering apparatus; cleaning meters and fuse boxes on consumers' premises.

Clerical Department.

Clerk.—Keeping installation register and notifying mains superintendent and meter superintendent of new applications; time sheets, checking and allocation; attending to ordering of material, &c., as requisitioned by various officials; prime cost of works; serving statutory notices on road authorities, and orders for reinstatement of trenches, &c.

Timekeeper and Storekeeper.—Should be a man of strict integrity and naturally punctual; he should be provided with an automatic time recorder to leave him free to distribute stores in the morning.

Publicity and Installation Department.

Superintendent.—Preparing attractive literature for distribution amongst probable consumers; supervision of showroom; estimates for installations, &c.

Canvasser.—Should be a man of good address with unlimited supply of tact and courtesy, which is essential to obtaining new business; follow up delivery of literature; be in touch with local estate agents and builders.

Salesman.—Should be a man who knows the right fittings to show customers; keep showroom in good order; keep stock, sales, inwards and outwards books, &c.

Emergency Men.—Should be semi-skilled men, capable of renewing fuses and attending to small faults on installations; time to be filled up by wiring fittings, &c., in showroom, and delivering goods, literature, &c.

Having now outlined the duties of the staff, we will proceed to describe the method of operation.

Application for Supply.

We will assume that an application for supply has been received which will involve an extension of the mains.

The distribution engineer sends for the mains superintendent and draughtsman, the latter producing the large scale plans of the particular portion of the district, and the former the records of the load and pressure on the local distributors. The distribution engineer will then decide if it is possible to extend the existing distributor to deal with the increased load, or if it is necessary to lay an additional distributor or feeder, the size of proposed extension, and calculated drop in pressure with the proposed additional load. The draughtsman will then prepare an estimate of the cost of the proposed extension, and the distribution engineer will inquire as to the financial stability of the applicant, and if found necessary, call for deposit and guarantee so as to ensure a reasonable return on the extension.

Assuming these points to be satisfactorily settled, the draughtsman will prepare the necessary plans, and after signature by the distribution engineer, will hand them to the clerk for posting with the statutory notices.

The clerk will enter application in register and post acknowledgment form to applicant and notice of commencement and completion forms to the contractor.

The mains superintendent will be informed of the extension, and will see that all necessary material is in stock, or if any more is required, the same will be duly requisitioned, the storekeeper informing the clerk, who after sanction by the distribution engineer will order the same.

The meter superintendent will be notified of the application, and if the necessary metering apparatus is not in stock, it will be requisitioned at the stores in the same way as by the mains superintendent.

When the metering apparatus is to hand, it will be tested and kept ready to be fixed when the installation is ready.

When the statutory notices have expired, the distribution engineer will instruct the mains superintendent to proceed with the laying of the mains and services, the records of the same being duly handed to the draughtsman, who will enter details on plans.

On completion, the extension will be tested by the mains superintendent, and the results entered in testing log and service book. Details of reinstatement and order for same will be sent to the road repairing authority.

The matter now awaits the return of the commencement form from the contractor, on receipt of which the installation inspector pays a visit to see that the work is being satisfactorily carried out; on receipt of completion form an appointment form is dispatched and the installation is tested, and, if satisfactory, connected, the meter superintendent having previously fixed his metering apparatus.

The meter-reading card is now made out, and head office notified that consumer has been connected.

Complaints.

Complaints as to quality of light are handed to the meter superintendent, who instructs the installation inspector to take a pressure reading; and as the majority of complaints will emanate from consumers who are probably not aware that electric lamps have sometimes to be renewed, he will probably find that a new lamp exhibited by the side of the consumer's old one will have a very pacifying effect, or, if that fails, recourse may be had to metallic-filament lamps. Even the cleaning of a lamp may often have a beneficial result, and every possible thing must be done to give the consumer satisfaction.

If the pressure is found to be below the standard, the distribution engineer will take the matter up with the mains superintendent to see if the distributors are overloaded, due to disconnection, &c., in the network.

If the complaint is regarding the meter or cost of the supply, the meter inspector will re-read to see that an error has not been made; and if this is found in order, he will make a rough test on site. Assuming that the meter is found to be registering inaccurately to the extent of 5 per cent., and providing that the consumer agrees to accept the company's test without appealing to the testing authority, the meter is brought to the test room and thoroughly checked, and the account for the current quarter adjusted accordingly.

Publicity and Installation Department.

Most undertakings now realise that it is essential to have some means of bringing the supply prominently before the public, and instead of a number of small contractors each making an attempt at a showroom, it is far better to centralise the effort and have a prominent showroom in a good position in the town under the direction of the supply authority.

The contractors would contribute towards its maintenance, and in return their names would be advertised, the work obtained would be distributed amongst them, and they would carry out the same at scheduled prices.

This system has been given a fair trial and found to be preferable to the supply authority carrying out the work direct, as it brings contractors and supply authorities' officials into close touch, which certainly tends to increase business.

The contractors bring their clients to the showroom and receive commission on sales, probably as much as they would receive from wholesale firms, as supply authorities can purchase largely and are always given the best discounts.

To return to the Publicity Department's direct connection with the supply authority, we will assume that instead of the definite application for supply referred to previously, only an inquiry had been received. This would be handed to the department superintendent, who would send a canvasser to interview the inquirer, and this would be followed up by the superintendent, who would take particulars of the installation and quote on scheduled prices for the wiring, the fittings being chosen by the applicant at the showroom.

Emergency.

It is now found necessary to keep a man constantly within call to replace fuses and attend to small jobs, and undoubtedly his best place is at the showroom, where he can fill up his time on odd jobs. Some people advocate making a charge for replacement of consumer's own fuses and attending to trivial repairs, but perhaps it is better to render this little service free, as the cost is so trifling and a little such attention does much to popularise the supply.

Whilst we are dealing with emergency, the mains gang must not be forgotton. The mains superintendent or mains foreman, a jointer and a few handy labourers should always be within call, ready to deal with a fault expeditiously. Sealed emergency bags containing disconnecting tools, portable lights, gloves, fuse wire, &c., should be kept at advantageous points, such as central station, showroom and sub-station, and be periodially inspected by the mains superintendent, and a report should be made to him whenever the seals are broken, so that anything used may be at once replaced.

The above few remarks are not put forward as propounding the absolutely best methods of organising the distribution department, but they are the outcome of several years of experience and have been found to meet practically all cases.

Every endeavour has been made to avoid too much red tape or system, having in mind the fact that we are not building up a model system, but endeavouring to sell electricity as cheaply as possible, and at the same time to show a reasonable return on the capital outlay.

Electric Capstans.—A step in the right direction has been made at Devonport, where the electrical installation in the dockyard has been extended to other uses than that of lighting. Some time ago it was decided to install electric capstans instead of the usual hydraulic bollards that are placed round the various docks for warping the ships into position. The advantages of electricity over hydraulic power are very great, and the new capstans are connected with the ordinary dockyard mains. They were subjected to a full-load acceptance trial on May 19th, and the results appear to have been entirely satisfactory. The 65-H.P. motors with which they are driven are capable of sustaining a load, through the gearing, of 65 tons.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Electrical Machinery Exports.

Your recent article on the *Daily Express* methods of propagating Tariff Reform is interesting to both sides. From an electrical engineering point of view, however, it would be interesting and instructive if, from the information which you doubtless have at your disposal, you could publish the following few figures in annual totals :—

(*a*) The exports of electrical machinery for, say, the last five years to the Continent.

(*b*) Ditto, ditto to the Colonies for the same period.

(*c*) Ditto, ditto to more or less non-manufacturing foreign countries, such as Japan, Brazil, Chile, Mexico, &c., where a Protective Tariff is more or less in force.

Such figures would be of much greater value than many columns of opinions, and would, I think, correct a good many opinions already formed without full knowledge of the facts.

Trusting you may see your way to publish such information.

Exporter.

June 3rd.

[The information required by our correspondent may be found by anyone who cares to search through our monthly returns, published during the past five years.

As a matter of curiosity, we have taken our last monthly statement—viz., April, 1909, and we add below the April export figures for the four previous years, the figures being only approximate and divided as our correspondent suggests :—

	To Continental countries.	To S. America, Mexico, Japan and China.	To principal Colonies and Dependencies.
April, 1905 ...	£4,500	£2,400	£11,500
April, 1906 ...	6,000	6,500	23,000
April, 1907 ...	14,800	25,000	28,700
April, 1908 ...	16,800	41,500	30,000
April, 1909 ...	18,600	43,800	71,000

We may point out that these figures represent entries under the heading of "Electrical machinery"; another heading is "Electrically-driven machinery," the entries under which have shown a falling tendency during the last year or two. For the information of our readers we publish below from our own Tables the April exact totals under the two heads during the past five years :—

April only.	1905.	1906.	1907.	1908.	1909.
Electrical machinery	£18,650	£37,702	£69,386	£92,875	£135,111
Electrically-driven machinery ...	11,705	16,471	15,940	4,120	9,003

It should be mentioned that electrically-driven machinery includes such items as travelling cranes, in which the electrical value forms only a small proportion of the whole.—Eds. E.R.]

Electricity in Cornish Mines.

The "hide-bound" conservatism of the Cornish tin mine manager, and the affection shown for the Cornish type of engine more especially for pumping, to which reference is made in a leaderette in your issue of May 28th, are almost entirely due to the many disastrous failures of electrical machinery in the Duchy, and manufacturers have themselves to blame for the prejudice at present existing against them.

In the early applications of electrical machinery, which were practically confined to pumping, consultants were considered unnecessary. Manufacturers accepted the work without knowledge of the special requirements that obtain, and installed apparatus totally unsuitable, with the inevitable result that at least the first six installations proved melancholy failures, and when liquidation of the mining company did not occur, the electrical machinery was promptly replaced by the Cornish engine. Until two years ago only one electrical pumping installation could be called successful, and the manufacturers who were responsible were justly rewarded by obtaining the bulk of the orders that have since been placed from the Duchy.

Another cause that may be added to those mentioned in your leaderette, is that in the area of the Camborne Supply Co. until recently the prices quoted were prohibitive, and progress was, and still is, handicapped by the M.D. system, which is only in isolated cases understood. Within recent times a valuable contract might have been obtained if the supply company had quoted in terms that could have been understood; a flat rate per unit would, no doubt, be difficult, but a fixed rate per horse-power per annum would, it is believed, have secured the contract, and as the conditions and load factor were almost identical with those which obtain at a neighbouring mine which purchases energy from the supply company, and to which the supply company have access, this should have been no impossibility.

To attain the desired end of the more general application of electricity in the Duchy, in the area of the supply company the hard and fast rule of M.D. should be dropped; at any rate, the company should go as far as possible to meet the difficulty of the imperfectly understood system. Where manufacturers are called in without the assistance of a consultant, they should be quite clear as to the work to be undertaken, and the conditions under which the apparatus has to operate, more especially in pumping problems, and they should make a careful study of the actual conditions on site, in co-operation with the selected pump manufacturer and the mine officials.

R. D. Gill.

Camborne, *June 1st*, 1909.

Telephone Agreements.

In order to correct a false impression which may be created by reason of the reports which have appeared in the Press, concerning our withdrawal from the appeal lodged by the National Telephone Co., Ltd., in the proceedings instituted against us to recover an account alleged to be due for message-rate calls, we request that you will kindly permit us to explain our position. Whilst, in common with other subscribers, we were willing to pay for the facilities we actually enjoy, yet we objected to meet a claim which even the Judge at the City of London Court characterised as insupportable, and in respect of which he entered judgment in our favour. Having won our case on the facts, we were not further interested in litigating the matter in the public interest, we deeming it not the duty of an individual company to contend against a monopoly such as the National Telephone Co., Ltd., who, having other subscribers bound by a similar contract to the one we were compelled to sign, would not hesitate as to the moneys they would expend in order to obtain a judicial decision upholding its validity. Having, however, established our contention before the County Court Judge, we withdrew from the contest, and trust that, in justice to ourselves, you will insert these few lines explanatory of our position in the matter.

Davies, Turner & Co., Ltd.

London, E.C., *June 8rd*, 1909.

Lightning Phenomena.

We had a curious experience of the effects of lightning during a short sharp storm last Wednesday.

Part of our district is supplied with bare overhead distributors on the negative side of the three-wire system. Eight houses are supplied with bare overhead services, and seven with underground services from the overhead distributor.

One of the houses with the underground service was struck by lightning, and the chimney and part of the roof destroyed; and inside the house, one hanging pendant was burnt up, and the three-way distribution board, main fuses and meter were completely destroyed.

In five houses within ¼ mile radius, but supplied from our ordinary underground main, the flexible wire of pendants

in various rooms was burned through, and circuit fuses blown, and in eight other houses supplied from our ordinary underground main, filaments of lamps were broken and bits of the filaments sticking to the glass bulbs.

In the writer's house, about a mile away from the house that was struck, a flexible wire attached to a voltmeter was burned through and a circuit fuse blown.

In another instance the flex. of a pendant, supplied with current from the positive side, was burned through and the main fuses blown.

In the eight houses supplied with overhead services, nothing out of the ordinary happened.

Our overhead main is fitted with lightning arresters and choking coils.

We shall be glad to hear if this is the usual thing that takes place with lightning, and if others have had a similar experience.

Chesham Electric Light and Power Co., Ltd.,
R. J. J. Swan.

Chesham, *June 1st*, 1909.

A Correction.

Referring to page 927 of your current issue, please allow me to say that you have apparently mistaken me for a gentleman who is a member of the Institution of Electrical Engineers, and whose initials and surname are the same as my own. As you know I have not misrepresented myself to you, I am sure you will regret with me the injury to that gentleman and to the Institution, and do all you can to make it known, that I am merely—

J. H. Davies.

Brighton, *June 5th*, 1909.

[We regret the mistake, which was entirely our own.—Eds. E.R.]

The Electrical Industry and Tariff Reform.

I note with some interest the controversy that is going on regarding the electrical industry and Tariff Reform, and while I do not believe that Tariff Reform can find work for all the street-corner loafers that do not want it, still, judging by results elsewhere, the question cannot be ignored.

In matters of this kind "an ounce of practice is worth a ton of theory," and it seems strange that despite the adoption of an unsound policy the home industrial and export trades of Germany, Austria, France, Italy, Japan and Canada have increased much faster than ours of late years.

I should like to have an explanation from a theoretical Free Trader (very few of them apply the theory to their own business) of the following circumstances: One of the leading German electrical firms has for a number of years carried on an important fittings and installation business in France, supplying lamps, accessories, motors, &c., but owing to the imposition of a reactionary tariff, they found themselves unable to compete with the French manufacturers.

They have recently erected a new factory near Paris, and work will be commenced in a few weeks' time with about 400 hands, French not German, and despite the tariff the output of the factory will be sold at German prices, and approximately the same prices as those ruling in England. The internal competition in France, as it would be in England, has proved quite sufficient to keep prices down to a reasonable level. Before many months this firm expects to employ about 1,000 French workpeople, though the whole of the British and Colonial business of this same firm is carried on with German material. If there was a tariff here this and a number of other firms that I know of would have to put up factories here or practically shut up shop, without any appreciable rise in prices.

There are over three million pounds' worth of foreign made motor cabs and 'buses running on the streets of London, and had they been made at home the public would not pay any higher fares, but over two millions would have been spent at home on labour.

Despite the pious declarations of the directors, the whole of the electric train equipment of the London, Brighton and South Coast Railway has been made in Germany, which could have been made in this country had there been any genuine intentions of doing so, work which would have been done here under a tariff. English workmen can make commutators, high-tension windings, switchgear and transformers quite as well as any Germans, and had the plant been made in this country not merely would many thousands of pounds have been spent on labour, but an appreciable sum would have been paid out of the profits of the manufacturers into the national exchequer as income-tax.

It would be interesting for a free trader to visit Montreal, Toronto, Hamilton and Peterboro, and find out how many of the factories there would be existing had there been Free Trade in Canada, and why the Canadian Liberal Party, formerly pledged to Free Trade, is now a consistent supporter of Protection.

A visit might also be paid to the textile districts in Saxony and Westphalia, to find out who did the business before this unsound protection system was adopted, where a large proportion of the output goes to now, and what country is mostly affected by their competition.

It is quite easy for a man to stick to an exploded theory and keep his eyes shut to facts, but there are plenty of business men in this country who would willingly put up with the theoretical disadvantages of a moderate tariff in order to obtain the relative stability and increase in business that has been found in other countries.

Theodore Rich.

London, S.W., *June 7th*, 1909.

Specifying for Sound Workmanship.

Much has been said from time to time in the electrical papers regarding the consulting engineer and his work. There is an aspect in which I have not seen him viewed, with the exception of an epistle which appears in the *Electrical Contractor* for the present month, and with which I heartily concur. That aspect has reference to the settlement of tenders, irrespective of the class of workmen who are eligible to do the work. While specifications insist on certain materials being used, no mention is made that the workmen laying the material shall be competent tradesmen. The result is that certain contractors, who employ the cheapest of labour, and a large number of boys, pass off shoddy work, for which they are able to tender at a much lower figure than the respectable firm.

This is the point which the electrical trade has had to face in many forms. Discredit is often brought upon the manufacturer, upon the efficiency of the supply of current, and a score of other causes, while bad workmanship is the source of the evil.

It is a question which has been touched many times, whether the consultant is a necessary link between the contractor and his work. The ignorance of some, and the indifference of others, who act as consultants, have done a vast amount of harm to the progress of electricity. I am of opinion that those who wish to install plant would do better to put the consulting engineer's fee towards the price of the job, and trust the work in the hands of a competent firm of standing, than be duped by many who call themselves consultants. They would fare better. Of course, I am not referring to the engineer of ability; only to the so-called.

Reform.

Mining Switchgear.

I am glad to see Mr. Burge's contribution (in your current issue), and must make the importance of the matter my excuse for trespassing again on your space.

Switchgear on the lines described by Mr. Burge has, I believe, been experimentally made by some of the Continental firms, who have also claimed a certain amount of success. There is, however, no need to copy these Continental makers, unless their gear embodies certain advantages which are not embodied by the gear at present made in our own country and of British design.

This type of gear with gauze windows and baffle plates would allow dust to accumulate inside the boxes if the vents were such as to allow gases to escape freely; if not, the boxes

would need to be strong enough to withstand internal pressures.

These windows would be liable to damage, with serious consequences, unless expensively made and shielded, and I do not believe this method would be cheaper if properly constructed than the heavier type of "flame and explosion-proof" gear which I described on page 876 of your last week's issue.

Now, we still have the joint to deal with between the covers and the boxes themselves, which in any case must be carefully fitted. Flexible packing, which is liable to deterioration, should be avoided, and this leaves us only with machined metal surfaces, which, as previously explained, can be made to do all that is required in preventing a flame from being blown through to the outside. The solidity of the heavy covers designed to withstand internal explosions is a recommendation for colliery work, in view of the rough handling the gear usually gets.

The heavier gear, therefore, appears more reliable for the following reasons :—

1. Little or no dust gets through to the interior of the box.

2. The joint between cover and box is the only path through which gases can escape, and which requires attention.

3. This joint being of machined metal, does not vary, and no flexible or unreliable packing is relied upon.

4. Being more solid, the gear is more suitable for withstanding rough colliery usage.

N.B.—An unnoticed fracture might, of course, produce serious or even fatal results.

Finally, I would add that colliery managers are alive to their responsibilities, which is partly proved by the increasing demand for gear of the kind I have endeavoured to outline. That there is also a large amount of unreliable and absolutely dangerous switchgear in use in collieries is beyond doubt, and it is equally unfortunate that it is only when these lamentable accidents occur—which could obviously have been avoided—that any general interest is taken in these matters. Manufacturers have done their part in spending money on experiments and designs, and, as Mr. Burge says, it rests entirely with the Home Office and the colliery management to determine when the gear used shall be chosen because of its suitability and safety instead of, as is mostly the case now, because of its price.

P. N. Rand.

Manchester, *June 7th*, 1909.

E.M.F. in a Dead Underground Cable.

Reading "Enquirer's" letter on this subject recalls a similar experience I had with lead-covered vulc. rubber 3/22 wire underground, and which I had intended bringing forward at one of our Institution meetings when the subject of cables for colliery work was discussed.

The whole circumstances are as follows: Colliery in Lancashire, direct-current supply, 500 volts; motor-houses and level roads in front of same installed with 3/22 lead-covered vulc. rubber wire. For greater safety, I re-wired motor-houses, &c., with 3/20 vulc. rubber wire run in steel tubing, owing to the risk of weighting which occurs in pits having steep workings.

After installing the tubing, when I came to take down the old lead-covered wire, I received a slight shock from it. My hands being very moist, as a rule, I am very sensitive to the slightest E.M.F., even a few volts. I mentioned the matter of the shock to my assistants, but they could not feel it. The manager coming on the scene, I also mentioned the matter to him, and he felt the wires, but received no perceptible shock. I then switched off all lights, and on putting the wires together there was a spark from positive to negative from lead to lead. On parting them and putting together again the spark flew from negative to positive, and so on alternately for over a dozen sparks.

The E.M.F. was quite sufficiently strong to fire several low-tension fuses for shots, and yet there had been no current through the conductors for nearly three months. The explanation I found on this point was that some time previously an earth leakage had occurred on the motor in that motor-house, and that the lead covering on the cable had thereby been charged like a Leyden jar, and acted as a condenser, and so discharged itself when the two lead-covered leads were brought together. I am prepared to give proof of the above to anyone inclined to doubt my statements, and I am inclined to think that lead-covered cables do have a tendency either to be affected with induced currents, or if once they come in contact with a live conductor to retain some of the E.M.F. and store it like a Leyden jar in the lead covering itself.

Therefore, I think it quite possible that the lead covering on the cable spoken of by "Enquirer" had taken up some of the high E.M.F. in the air or from the earth through the jointer's body, and would suggest a connection being made from the lead covering on the cable to a lead water-pipe in the vicinity with a 2-volt lamp inserted, and the connection made and broken, and for him to see if any sparking takes place at points of contact, or if at time of contact it does not show a light on the 2-volt lamp spoken of.

J. Williams,
Hon. Sec., I.M.E.E.

Whitehaven, *June 7th*, 1909.

Engineer's Department v. Accountant's Department.

There is no doubt that the interests of the engineer's department and the accountant's department are mutual, and, further, there is no reason why there should be friction, but "Accountant's" letter clearly gives the reason why there is friction; his letter spells "jealousy" throughout, and is a compilation of lame attempt at humour and shallow sarcasm. How dare any member of the works department know anything of accountancy? Moreover, how dare he have the cheek colossal to write an article on any matter whatever appertaining to books? I am sure there was nothing whatever in the article by "Interested" that "Accountant" could really take exception to, but it has evidently ruffled him, and he takes the very earliest opportunity of endeavouring to belittle the works staff. We know that the commercial department of an electricity supply undertaking is gaining in importance day in and day out, and for some time past certain officials have been looking at it with greedy eyes.

With regard to "Accountant's" remarks, "the accounts are entered on the Dr. side of creditors' account"; a little common sense will tell him it is evident that they are first entered on the Cr. side of the account, and an entry made on the Dr. side *only* after certification for payment, which is perfectly in order; if not, "Please let us know, 'Accountant,' we are willing to learn, we are only seeking information." The remark *re* scratching out and pinning paper in the ledger is unworthy of one who calls himself an accountant, because it needs no one with any great knowledge of accountancy to know that it would be a simple matter, if the account was not passed at the committee meeting, to Cr. creditors' account again, and Dr. a corresponding account.

Re remarks about cash-book, "Accountant" should know that cash-books, as a rule, are not kept at the works; and as he kindly informs us, for every debit there should be a credit, it would be an easy matter for a "certified for payment account" to be credited with the amount, previous to the creditors' account being debited with the amount certified for payment, and if not sanctioned when presented to the committee for payment, it could be dealt with as before described. With regard to the account cards being kept in drawers, this is simply a matter of opinion; some prefer cards, others books.

Anent the remarks *re* any payment made being sent direct to the borough accountant without any record being made, what would "Accountant" do if he received a cheque sent him in error—make a record of it in his account books? I think not.

Regarding the concluding portion of his letter, the clerical staff must necessarily possess a certain technical knowledge, and do, and the same applies in all other industries; commercial technical knowledge is a necessity, otherwise the staff would be of no use, and further, there are accountants in the works department equally as clever and capable in their own sphere as the borough accountant is in

his; if less jealousy existed on the part of some of the borough accountants, there would be no friction whatever, but they want to grab all. No doubt, when the "finance officer" takes charge of the undertaking the clouds will roll away?

Quid Nunc.

With regard to the long letter in your last issue by "Accountant," I do not propose going into a lengthy warfare with him. The general tone of his epistle seems to be the same as that shown in the draft regulations for "Financial Organisation and Administration," drawn up by the Institute of Municipal Treasurers and Accountants, and anyone reading those proposed regulations cannot help noticing on which side is the bias.

Interested.

Several letters have been received too late for insertion.—EDS. E.R.

ELECTRICAL ACCIDENTS IN 1908.

THE report of the Electrical Inspector of Factories, Mr. G. Scott Ram, for the year 1908, was issued last week, and contains much interesting matter. It appears that the horse-power of the motors connected to the mains of electricity supply undertakings has increased by about 24 per cent., and amounts to more than 443,000 H.P., showing that other forms of power are being very rapidly superseded by electricity. The accidents which occurred during the year are given in the accompanying tables. There is a slight increase in those included in Table I, partly due to the inclusion of railway generating and sub-stations not previously included, which accounts for 17 of the mechanical, and 11 of the electrical accidents. The large number of accidents met with in cleaning or repairing live switchboards, &c., might, in Mr. Ram's opinion, have been greatly reduced, as it was not really necessary to do the work while the conductors were live; several of these occurred where the cell actually being worked on had been made dead, the workman having, by some means, made contact with the live gear in adjoining cells. It is interesting to note that in one case a man was brought round, after being unconscious for two hours, by the use of Sylvester's method of artificial respiration. In many cases, as usual, the victims had only their own carelessness to blame. Several serious accidents were experienced by attendants whose hands were dragged in between commutator and brush-holder while cleaning the former.

TABLE I.—ACCIDENTS AT ELECTRICAL GENERATING STATIONS AND SUB-STATIONS, 1908.

Description. (1)	Companies and local authorities giving a supply by way of trade, and electric railways.		Private stations.	
	Non-fatal. (2)	Fatal. (3)	Non-fatal. (4)	Fatal. (5)
Non-electrical.				
At engines, pumps and generators	30	—	6	—
At boilers and steam plant...	58	—	8	—
At coal-handling plant ...	20	—	2	—
Falls	80	2	9	—
Struck by falling bodies ...	36	—	3	—
Miscellaneous	87	1	7	—
	311	3	35	—
Electrical.				
At switchboards, when engaged in ordinary routine work; mostly due to faulty design of apparatus, or to mistakes on the part of the switchman	10	—	7	—
Cleaning, repairing, &c., at "live" switchboards or other "live" conductors...	35	1	5	—
Cleaning, repairing, or other handling of switchboards supposed to have been made "dead":—				
(*a*) Skilled persons ...	3	—	—	—
(*b*) Unskilled persons ...	—	—	—	—
Adjusting brushes, cleaning or lubricating commutators	16	—	2	—
Miscellaneous	10	1	2	—
	74	2	16	—

TABLE II.—REPORTED ELECTRICAL ACCIDENTS IN FACTORIES, ENGINEERING WORKS, &c., OTHER THAN ELECTRICAL GENERATING STATIONS AND SUB-STATIONS, 1908.

Description. (1)	Non-fatal. (2)	Fatal. (3)
Arcing of { switches	27	—
Arcing of { fuses	19	—
Arcing at fuses, when replacing fuse wires ...	21	—
Portable apparatus, connectors and flexible wires	42	—
Unprotected conductors, switches, terminals, fuses, &c.	26	2
Working on live conductors: { skilled persons	22	—
Working on live conductors: { unskilled persons	10	1
Miscellaneous accidents in electrical manufacturing works—mostly in testing operations	22	4
Miscellaneous	33	5
	222	12

The number of accidents under this table is somewhat less than last year, but the number of fatalities is greater. Those due to arcing of switches occurred with only a few exceptions at motor switches and starters—18 when switching on or starting, and five when switching off. The injuries, burns to the hand, arm or face, were due to the absence of any protection or to inadequate protection of the switches. Those due to the arcing of fuses were mostly due to the absence of any protection at the fuse wires. Nine of them were at motor-starting panels, where the man starting the motor is necessarily close to the fuses. Most of the accidents in replacing fuses were due to short-circuits with bare metal fuse wires, owing to there being no switch by which the pressure could be first cut off from the terminals.

The number of accidents in the use of portable apparatus is considerable. In three the main injuries were shock in the use of hand lamps. In the remainder the injuries were burns due to short-circuits. Fifteen of these, causing in most cases severe injuries to the man's hand, occurred when inserting the plug of the connector into the socket. Plug connectors as ordinarily designed are not satisfactory. Portable apparatus, whether a hand lamp or anything else, and its flexible wires are very liable to get damaged when not in use, a short-circuit in the conductors being formed. This is not detected until the next occasion that the apparatus is brought into use; an attempt is then made to put the plug into a live socket. The result is a flash at the contacts which burns the man's hand. In many cases the short-circuit is actually in the plug itself, through the wires getting loose at the terminals or through the plug, particularly if made of porcelain, having been broken; or it may occur at the point where the flexible wires enter the plug, and where, through frequent bending and rubbing against the edge of the hole, the insulation becomes worn through or some of the separate wires becoming broken pierce the insulating material. In this case, owing to the plugs being so designed that the flexible wires pass out at the end through the man's hand as he holds the plug, the flash occurs actually in his hand. The flash from the short-circuit is often very severe on account of the circuit being much too heavily fused. Such accidents might be entirely avoided if electrical manufacturers would give these matters consideration in the design of the plugs. There is no difficulty in the matter, and a safe plug need be no more expensive or cumbrous than an ordinary one. Such a plug should be arranged, first, so that the flexible wires enter it from below and not at the end, so that the wires do not pass through the hand of the person using it. Incidentally, this arrangement offers the further advantage that the wires are not bent at the point where they enter the plug, the insulation being therefore less likely to be damaged at that spot, and, further, the wires are less likely to get loose in the terminals, as persons cannot pull the plug out by means of the flexible wires, as is not unfrequently done in the case of ordinary plugs. There should be a sufficiently large handle to afford a good grip. Between this handle and the live metal of the contact pins, terminals, &c., there should be a circular disk or shield to protect the user's hand in case of a flash at the moment of inserting the plug. The guard disk need not be large; for small plugs suitable for a hand lamp, 2½ in. diameter would be sufficient. The flexible wires should enter the plug on the side of the guard disk away from the handle.

The accidents through unprotected conductors are mostly of a preventable nature. It is not sufficient that dangerous wires should be placed out of reach merely of persons on the ground; they should be out of reach from any position or place in which any person is likely to have to be, particularly roofs of buildings.

Working on live conductors on factory premises is generally quite unnecessary, as the work can be done after factory hours, when the electrical installation can be shut down. The danger involved in such working is evident from the fact that 22 of the 33 accidents occurred to skilled persons, that is to say, persons described as "electricians" or "electrical engineers" and who should be fully acquainted with the risks. In the corresponding accidents to unskilled persons, someone other than the victim is generally to blame in setting him to do work for which he is not competent. In the fatal case a boy of 16 was instructed to reverse the connections at the terminals of an alternating-current motor working at 275 volts pressure. There was no switch provided in the circuit whereby the pressure could have been first cut off.

The entire absence of the most elementary precautions in this case, in spite of previous accidents, affords another example of the necessity for regulations.

The accidents in testing departments of electrical manufacturing works include four fatal cases. It is remarkable that the average age of 21 of the persons meeting with accidents in this class is only 20 years. Many of them are described as apprentice electrical engineers. The reason of this is, no doubt, that the young apprentice likes to get into the testing department, as the work is more interesting and instructive, and probably less irksome than in the shops, and, on the other hand, he is useful to the employers on account of having had some training in a technical college. There can be no objection to the employment of young apprentices in this work provided that there is a responsible competent person to supervise the operations. The apprentice seldom has an adequate appreciation of the dangers, and takes risks which an older man would shun. Whilst many testing departments are most carefully conducted and supervised, there are others quite the reverse. The work of such a department frequently requires temporary arrangements of conductors and apparatus varying with each test, but this is no reason for neglecting the corresponding necessary temporary precautions. Much of the apparatus and conductors can, however, generally be arranged in a permanent manner and permanently safeguarded, and this should always be done as far as practicable. In some works anything is considered good enough for the test room. Switches without any quick-break action and which would not be tolerated for similar work elsewhere are used; cables with the insulating material hanging in shreds are considered good enough, and so on, adding unnecessarily to the risks. Three of the fatalities occurred in connection with pressure testing. One was due to the inadequate guarding of a wire carrying a pressure of 20,000 volts. There was only a single bar wood fence insecurely fixed to screen off this wire and the apparatus in use from the rest of the test room, the wire being only a few inches within the fence. An apprentice was employed a few feet away at a table; he subsequently got up from the table and came into contact with the wire and was killed. A securely fixed and adequate fence should be used for such work, but can, of course, be arranged so as to be readily removable. Another of the fatal cases also emphasises the necessity of adequate fencing to keep persons away from danger during pressure testing; this occurred at the testing tank in a cable works. There was a single bar barrier at the entrance to the gangway alongside the tank, and danger notices were exhibited. A man employed at the test tank, in preparing the connections to the cables for testing, evidently did not consider that the notices applied to him. He passed the barrier and the notices, came into contact with a 6,000-volt lead and was instantly killed. Another fatality occurred in the testing of mica tubes, the victim taking hold of the end of the test cable before the pressure was off. Precisely what led him to make this mistake is not clear. The fourth case was of an unusual kind, and appears to have been due to a very high instantaneous pressure, produced by breaking the field circuit of a large motor, giving a severe shock to a man holding the hand wheel of a rheostat in the circuit, although the hand wheel was insulated from the moving arm of the rheostat sufficiently for ordinary purposes.

(To be continued.)

OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"Enquirer" writes:—"This Council, which furnishes a supply of energy (alternating) for public and private lighting and power, under a provisional order granted by the Board of Trade, has before it an application for a supply of energy at 'power' rate, to be used to drive a motor-generator for the sole purpose of charging accumulators, the accumulators so charged not being for the use of the applicant, but for the general public. Is it within the powers of the Council to decline to supply at 'power' rate, since the Council has special plant laid down for this purpose?"

*** It would seem from the facts above stated that the consumer in question is anxious to get a supply at power rates in order that he may make a profit by storing the electricity and selling it at an increased rate for general purposes, which probably include lighting. This would seem to involve a colourable evasion of the Electric Lighting Acts. A supply authority is entitled to charge at a statutory rate for electricity used for lighting purposes. Owing to the fact that supply for power is generally used in the daytime, it can, with economy, afford to charge less for electricity used for motive power. Assuming that "Enquirer" is satisfied of the truth of the facts stated, he would be justified in refusing to grant a supply on the terms mentioned. At the same time, it must be confessed that this is a mere expression of opinion for which there is no direct authority. The fact that the supply authority generates an alternating current is a disturbing element. Alternating current used at one time to be unsuitable for the arc lamp—or, at any rate, unsuitable for that form of lamp when used in a magic lantern. Could a consumer be prevented from taking current at power rates in order to transform it for use in his magic lantern? This would be a difficult question for a court of law. If, in the case suggested by "Enquirer," the supply from the accumulators was to be used for miscellaneous purposes other than lighting, it is difficult to see how the use of the motor-generator could be prevented.

REVIEWS.

Submarine Cable Laying and Repairing. By H. D. Wilkinson, M.I.E.E. London: The *Electrician* Printing and Publishing Co., Ltd. 1909. Price 15s. net.

We cordially congratulate Mr. H. D. Wilkinson on the completion of this second edition, on which he has spared no pains to bring it up to date and retain for it the prominent place which it well deserves among the standard works on modern practice in manufacturing, laying, repairing and testing submarine cables. In reading this work one is impressed with the fact that it is written by a practical man, thoroughly experienced in both branches of the science about which he is writing. Instead of its being merely a collation from various sources, the way in which every subject is discussed gives evidence of originality.

We welcome the very great improvement not only in the natural order and sequence in which the sections are dealt with, but also in the much more complete index in which every subject, as well as the names of contributors and authorities, is given, which greatly facilitates reference.

In our comments on the contents of this book we propose to observe the same order, and to confine them almost exclusively to new matter not in the first edition.

Sounding.—In connection with the all-important question of sounding the route, on page 33 we read: "When it is possible to have a vessel sounding ahead of the cable steamer during the laying of a cable, the chances are that banks will be detected in time to alter the course." . . . "To take the place of this, a system of sounding is organised on board the cable ship while laying cable, and for this purpose it is not necessary to find the actual depth, but to ascertain if any rise in the ocean bed of importance occurs along the route." The only safe system, especially in the neighbourhood of the coast or islands, is to well sound the proposed route at moderate distances of, say, 10 or 20 miles *before* paying out, and when the depth is found to vary unexpectedly, to make a more thorough sounding survey of the locality. It was in this way that the "Dacia Bank," 120 miles to the N. of Lanzarote (Canary Islands), was found and avoided; whereas the failure to discover the "Conception Bank" (60 miles to the N.E. of the same island), and the "Seine Bank" (about 150 miles N.E. of Madeira), until too late, resulted in both cables laid across them breaking in shallow water, the existence of which was not suspected.

Speed of Signalling.—The important question of *speed constant* or speed attainable on a given cable is fully explained. Applying the data of the 1894 Anglo-American cable—(viz., $CR = 1{\cdot}682\Omega$ per naut.; $IC = 0{\cdot}420$ mfd. per naut.; length = 1,847 naut.), Mr. Wilkinson obtains from the usual speed constant formula a value of 597 (p. 41), assuming a speed for this cable of 249 letters per minute, and two extra spaces for every word of five letters, as given by Mr. Patrick B. Delany in the *Electrician*, November 30th, 1894. This basis, as the author points out, agrees very closely with the corresponding value—viz., 3·6 contacts per average letter or 3·8 allowing for spaces between words, independently arrived at both by the Eastern Telegraph Co. and by Mr. E. Raymond-Barker (see Electrical Review, Vol. XL, pp. 517 and 600, and the *Electrician*, April 23rd, 1897).

In another example, on p. 39, where a cable 2,000 nauts. long with 0·3 mfd. capacity and 5 ohms per naut. is assumed to carry 120 letters per minute, the speed constant is equivalent to 720. This is not excessive, but the author remarks that "in practice it may be" anything from about 600 to 900 according to the conditions of working, as affected by battery power, capacity of signalling condensers, and sensitiveness of the receiving instrument.

While recognising that the constant is dependent on the best conditions being employed, including the skilful and experienced adjustment of the recorder suspension to give the best definition, we think the above assumed value of 720 represents the full practical limit for continuous simplex working. The speed constant which the writer of this review has adopted, on the basis of actual simplex working on one of the long cables, is 700. As the constant on this cable for 2,000 words at a stretch was 730, the 700 value adopted for a safe figure is not at all excessive, as the definition of signals at this lower speed was very good.

F

Design of Cable.—The figure adopted in formula 16 for the sectional area in square mils for a solid cylinder 1 naut. long and weighing 1 lb. is 470 for compounded gutta-percha, instead of the old value 491, as given in Clark and Sabine's "Electrical Tables and Formulæ." The mean result of five samples recently obtained by the writer at 60° F. closely corroborates this; but since the gutta contracts appreciably while cooling, the figure would be below 470 at a colder temperature. At about 180° F. some of these samples were about 4½ per cent. greater in bulk, giving a mean value of 492.

Corrections.—A misprint has crept in on page 49, where it is said "the insulation resistance of a cable having the diameters in the ratio of 2·718 to 1 is $3,830/2\pi$ megs per naut. at 75° F. Here the denominator 2π has obviously been inadvertently introduced, and the same slip occurs in connection with the capacity (page 53) for the same ratio for D/d. This ratio, given as 2·718, should, by the way, be 2·729, and the capacity per naut. cube 0·366 K log (D/d), instead of 0·336 K log (D/d).

Weight of 7-strand copper conductor.—This is given (p. 50) as $d^2/69$ per naut. It should be stated that d is the *over-all* diameter, and that the area of the outer interstices —19 per cent. of the whole circumscribing circle—should be taken into account when calculating the weight of the dielectric; and in log (D/d) for capacity and D R, when comparing stranded and solid wires.

The resistance (r) of a 7-strand of w lb. per naut. is given (p. 54) as $r = 1,164/w$ ohms; the constant 1,164 being said to be the resistance per naut. of a 7-wire strand of high-conductivity copper at 60° F. (according to the Committee Standard), and 1,111 ohms at 40° F. The resistance for 1,000 yards, as given in the Engineering Committee's Table, is 5·672 standard ohms for a 7/22 strand weighing 89·22 lb. per statute mile; *i.e.*, 11·508 ohms per naut. weighing 102·58 lb., or 1,183·7 ohms per naut. pound at 60°, and 1,130·8 ohms at 40° F.

We read on page 56 "it is better to put in a 12 strand (No. 18 gauge) to utilise more of the available area, and give more flexibility" than a 7 No. 16 gauge strand. This is evidently a slip, because 12 equal wires do not form a regular strand, and therefore more space would be wasted.

Megohms per Microfarad.—The product of insulation resistance at 75° F. and the capacity per naut., it is said (page 54), is a *constant* for the particular dielectric, and "may be used to determine the capacity per naut. from the resistance per naut." It is true that D R varies directly, and the I C inversely, as log (D/d); but, considering how greatly the D R of even the same sample of gutta varies by maturing, and by slightly different conditions of treatment during manufacture, evaluating the capacity per naut. of a section containing several coils from the measured D R per naut. at 75° cannot be expected to give a reliable result.

In example (page 55) following equation (16) for calculating the weights of conductor and gutta-percha, the former is evaluated as 548 lb., but when calculating the weight of gutta the conductor weight is taken as 475, instead of 548 lb.

The practical use of Curve B and formula (11) is discounted considerably, as they are based on an assumed D R per cubic naut. of 3,830, whereas the value of this particular constant varies greatly with the kind of gutta employed. This remark applies also to Curve C and formula (13), based on an assumed capacity per cube naut. It must be understood, therefore, as Mr. Wilkinson explains on page 50, that "it was never his intention to employ absolute constants."

Types of Cable.—On page 82 we are told that "for the heaviest type of shore end the sheath is always double, and weighs about 17 tons per naut." "A finished shore end having 17 tons of iron per naut. would weigh about 22 tons in air."

This by no means represents the heaviest type, as is shown by the following made by the Silvertown Telegraph Co.:—The S E type made for the Japanese Government, and having eight cores and two sheathings in 1899, weighs 28·2 tons per naut., dry in air; the Antofagasta (Chile) T piece of the C. and S.A. Telegraph Co. (one core) in 1906 weighs 31·97 tons per naut. Again, the S E of a cable made by the Construction and Maintenance Co., and to be laid this year in the harbour of St. John's, Newfoundland, consists of two cables of 36 steel sheathing wires (·045 in.) laid up, wormed and served and threaded through steel ferrules 3 in. long, and weighs 60·3 tons per naut.

Welding.—The important process of electric welding the iron or steel sheathing is clearly described and illustrated in fig. 46, which shows the form of machine supplied by the Electric Welding Co., Ltd. To obtain a good result for steel with high breaking strain, a "snap" weld, *i.e.*, with a short application of the current, is necessary to prevent over-heating from unduly reducing the tensile strength. An improved form of transformer for use in electric welding machines of this type, designed by Messrs. Reginald J. Wallis-Jones and M. A. F. Berry, is also illustrated in fig. 47. This machine is said to combine more efficiency with less weight, size and cost. As electrical welds are more regular and satisfactory, and are effected in a few seconds only, this process has practically superseded hand-welding and brazing.

Speed of Paying Out.—Mr. Wilkinson says (p. 302): "The rotometer may register as much as 8 nauts of cable going out per hour, if the set of the current is with the ship." This does not represent a very high speed, seeing that, with large cable tanks, as much as 10 nauts per hour has been paid out, to the writer's knowledge.

Cable-Laying.—From among much other interesting information, we extract from page 143 the following remarkable and historical achievement of the Telegraph Construction and Maintenance Co.:—

"Between 1900 and 1903 the Telegraph Construction and Maintenance Co. laid cables completely round the world," as follows:—"The direct cable from England to the Cape—*i.e.*, touching at islands *not* the coast—laid in 1900 and afterwards extended by way of Mauritius, Cocos, Fremantle and Adelaide;" the Cocos-Fremantle section being laid across a part of the South Indian Ocean known as the "Wharton deep" of 3,500 fms.

"In 1900 the cable from Germany to New York was laid. The girdle round the world was completed in October, 1902, by the laying of the Pacific cable between Queensland, Norfolk Island, New Zealand, Fiji, Fanning Island, and Canada." "This system of cables totalled up to 29,000 miles, and including other smaller cables made in the same period by this famous company, there were 37,000 miles of cable produced, equal to 40 miles a day throughout the three years."

The Cable-ship on Repairs.—Speaking Apparatus.—Mention might be made of the special coil with broad ribbon suspension, the curbing effect of which is so great that well-defined signals have been obtained through an Atlantic cable without employing either sending or receiving condensers.

Inductive Signalling.—In the next edition will, no doubt, be included the very important system of inductive signalling which has of late been successfully employed by Mr. E. Raymond-Barker, of the Silvertown Submarine Telegraph Department, to enable the repairing ship to exchange messages with the shore station while making the final joint and splice. This is effected by Mr. E. Raymond-Barker's two-tone transmitter, in conjunction with the well-known "Fault-searcher" of Mr. John Gott, consulting electrician of the Commercial Cable Co. The ship sends or receives telephonic signals through one and the same Gott coil attached outside the cable sheathing. The shore connects a similar coil either direct to the cable conductor, or else (for short-distance signalling) applies it close to the surface of some portion of the line circuit, leaving the conductor undisturbed to earth through the office signalling instrument.

Up to the present the most striking examples of this inductive signalling have in actual practice been:—

(*a*) 60 miles from shore over a cable K R of 3,905.

(*b*) 51 miles from shore over a cable of K R 10,218.

Buoying the End of a Cable.—We do not find any remarks on p. 221 about sealing the core end before buoying. It not infrequently happens that the seal gets damaged because little time is allowed for the gutta-percha to get cold. A very good method consists in putting over the sealed end a split gutta-percha cap about 3 in. long, made to fit the core. The edges are simply warmed to make them adhere together, and after protecting this by a stout brass tube closed at one end, the whole is covered with the sheathing wires. The insulation depends entirely upon the seal being good, the gutta-percha cap (into which the water enters) being merely a protection which permits

of the end being handled without damaging the seal while putting on the metal cap.

Joints in Core.—On p. 207 we read, "Jointers very seldom fail to make a perfect joint." We cannot entirely endorse this in the case of old core, having had experience to the contrary. We suggest that the life of a joint would often be prolonged if, instead of using saliva, the fingers were moistened on a piece of clean linen wet with water (preferably distilled) while closing the seam of each gutta-percha covering (and more especially the first coating) and when working together the old and new gum at the ends of the joint.

Earth for D R Testing.—Sufficient attention is not drawn to the great importance of securing a very perfect earth by soldering a connecting wire to every one of the sheathing wires. The employment of the cable tank, of the ship's metal frame, or both is not a sufficient substitute for the sheathing wires, if the cable in the tanks be dry and the ship rolls heavily. One wire unconnected, or even a loose unsoldered connection on one wire, not infrequently causes anxiety by unexpected "kicks," especially when a long length is in circuit.

Reducing the D R to 75° F.—On page 47 the coefficient for the *mean* temperature of the laid cable is used to reduce the measured D R (6,500 megohms per naut.) to 75° F. This will give a very incorrect result when parts of the cable are at different temperatures. The correct result can only be obtained by reducing the measured D R of the laid cable to 75° from the observed sea-bottom temperature and relative D R values, as core at 75°, of each of the several sections of which it is composed. The calculated result should then be corrected for the mean pressure. A bottom temperature curve should be plotted from observed temperatures along the route, so as to obtain intermediate values, especially at the ends, for this calculation. See the ELECTRICAL REVIEW January 2nd, 1903.

Universal Shunt.—Although the Universal shunt is an essential with suspended-coil galvanometers, and is an advantage also with the Kelvin astatic galvanometer for "discharge" tests, yet some reference to the laws of *ordinary* shunts and derived circuits should be given for the benefit of students using this book, who have only the astatic galvanometer and ordinary resistance coils for shunts.

Testing Keys.—The description of the Rymer-Jones "discharge key" is somewhat confused where it says that "it has the advantage over the ordinary reversing testing key that the line can be insulated if required." The galvanometer or battery reverser, it is correctly explained, has an extra pillar with rubbing contacts, which can be withdrawn if required to convert it into an ordinary discharge key. An illustration of this reverser would make this plain, and the short-circuit key (ELECTRICAL REVIEW, June 15th, 1900) might also be included to complete the set of these useful testing keys.

Fault Localisation.—This section has been greatly enlarged by the addition of the most up-to-date methods.

Most of these tests are not of recent date, and cable electricians will recognise them as already well-tried friends, so it is not necessary to remark on their individual merits, except in the case of the Rymer-Jones high-resistance break test, which, though published in 1901, has recently been revised and much simplified. It will be appreciated by cable electricians that the localisation of a high-resistance break of, say, 20,000 ohms, presents exceptional difficulties, and the very exact results of various high-resistance breaks, as evidenced by the examples published in the ELECTRICAL REVIEW, show that the test admirably fulfils its objects.

Fall of Potential Test.—This test is explained both when measuring the potentials, P, p and p_1, by *discharge*, and also by null method when employing the Kelvin and Varley slides. We notice, however, that no reference is made to the correction for *cable current*, which, if not taken into account, may seriously affect the localisation result. As the cable current varies rapidly, it should be observed both at p and p_1 almost immediately after taking off the testing current.

It is a remarkable fact that this method, which is the most perfect and simple of partial earth tests if properly applied, is so little appreciated and understood.

We wish to conclude this review by congratulating Mr. Wilkinson on having so largely added to the value of his book. Our having rather fully commented on the contents, we hope he will consider as an evidence of the importance we attach to it as a thoroughly practical text-book.

BUSINESS NOTES.

Meter Approved.—The Board of Trade has announced its approval of the Westinghouse type N single-phase, watt-hour meter No. B 116,660, deposited by the BRITISH WESTINGHOUSE Co. on March 5th, 1908.

German Insulated Wire Syndicate.—A scheme has been in course of promotion in Germany for a long time past with the object of forming a syndicate of the works which manufacture insulated conductors. A meeting for the purpose of accelerating the efforts has just been held in Berlin, when a committee, representing makers in the north, the west and central districts and the south, was appointed to proceed with the preliminary work.

Revision of Swedish Customs Tariff.—A scheme for the revision of the Customs tariff of Sweden was brought forward several months ago, and it will be submitted for consideration on the re-assembly of Parliament early in 1910. Although the details have not yet been officially published, many of the alterations proposed in the existing tariff have already become known in consequence of the presentation of a report by the Customs Commission to the Ministry of Finance. Among these may be mentioned the following:—The duty on insulators for electrical conductors is to be reduced; the rate on copper cables is to be from 10 ore to 12 ore per kilogramme according to dimensions; copper wire, 10 to 12 ore; and trolley wire 10 ore per kilogramme. The duty on machinery, which has hitherto been included under a single number bearing an *ad valorem* rate of 10 per cent., has been divided under 116 different headings, and electrical machinery has been specialised into 24 classes. Except where special reasons exist, the principle of the imposition of duty according to weight has been completely carried out in the new tariff scheme, and only in individual cases, such as in those of electrical and other machinery not specifically set forth, automobiles, &c., has the system of *ad valorem* duties been maintained. The Customs Commission has abstained from preparing a double tariff system, as Sweden stands in most-favoured-nation clause relations with almost all other countries, and such a tariff is therefore regarded as inappropriate. On the other hand, powers of retaliation are proposed, so that in case of a Customs war the goods from the country concerned could be rendered subject to a surtax up to 100 per cent., or if duty free, they could be taxed to the amount of their value. It is intended to totally exempt from duty wrappers or coverings which only serve the purpose of protecting goods during transport, this proposal being stated to be of special importance.

Exhibitions Abroad.—RUSSIA.—It was proposed at the Anglo-Russian Chamber of Commerce at St. Petersburg that a Russian Exhibition for export goods should be held in London in 1911. The *Financier* adds the excellent suggestion for a return English exhibition in St. Petersburg. The Russian desire to do business with this country, upon which we wrote at length some months ago, should go a long way to make the latter proposition well worthy of adoption. It is clearly proved every day that we cannot know a nation well enough commercially unless we get closely into touch with its people on their own soil. The peoples of different countries never were so near together as they are now—yet it seems to us that a tour to Africa or through Canada or to India is thought less trouble and more important than a visit to Russia or Spain or some other countries nearer home, which ought to be studied better by us. Foreign exhibitions should afford splendid opportunities for getting to understand the ways of the people better, conducing to far more successful business relations.

AFRICA.—A Reuter dispatch from Capetown states that the South African National Union has decided to postpone the International Exhibition which it was recently resolved should be opened in South Africa on the occasion of the meeting of the first United Parliament, and to hold instead a South African Exhibition, to include international exhibits, agricultural implements, electrical appliances, motor-cars, and other machinery.

The Sun Patent Evaporator.—This is not, as might be supposed from the title, a solar heat system; it is a device which, it is claimed, saves 10 to 20 per cent. of fuel in ordinary steam boilers. The principle of the apparatus—which is being put forward by the SUN PATENT EVAPORATOR Co., of 427, Tower Buildings, Water Street, Liverpool—is as follows: Steam drawn from the boiler is superheated, passed through a series of tubes in the water space, and returned at the temperature of saturated steam to a secondary superheater, where it is dried and slightly superheated before passing into the steam mains. It is stated that the device is based upon the fact that a thin metal plate is a far more efficient heat conductor than a thick one. Here we are obliged to differ from the patentees; the idea that efficiency of evaporation is in the least affected by the thickness or material of the plates or tubes is dead and buried, and its resurrection is not to be commended. The great fall of temperature between the hot gases and

the comparatively cold water takes place not in the body of the plate, but outside it altogether. This apart, however, the Sun evaporator is a device for capturing some heat from the gases and conveying it to the water in the boiler. Were it situated in the flue beyond the boiler, it might effect an economy, just as the ordinary economiser reduces the loss of heat in the flue gases; it is, however, in the downtake of a Lancashire or similar boiler, and is therefore, as stated by the makers, "in contact with gases at a very high temperature." That is as much as to say that the heat is captured before it has entered the category of "waste heat"—for the gases have a lot of work to do on the boiler after passing this spot. We are unable to credit any economy due to this cause, therefore; but it is also claimed that a thorough internal water circulation is set up. Good circulation adds to the efficiency, and as one set of heating tubes is placed below the flues, no doubt the circulation is improved; half the tubes, however, are just above the crowns of the flues, where their effect cannot add materially to that of the flues. The claims made for this invention take our breath away; one statement is that, "as might be expected, there is found to be a very noticeable reduction in the time taken to raise steam in boilers fitted with the evaporator." As there can obviously be no steam in the tubes during this process, and we see no provision for flooding them with water, we fail to see what possible effect they can have before boiling point is reached. We should say, however, that there is a very good chance of burning the tubes.

Consular Notes.—Roumania.—The Austrian Consul at Crajova reports that there is a good opening in his district for electric lighting materials, owing to the extended use of electricity. Supplies at present are for the most part from Germany, but these goods are also imported in a smaller degree from Austria and Switzerland.

Australia.—The Austrian Consul at Sydney reports that in the mining statistics of Australia, copper takes the third place, the value of the production in 1907 being £3,500,000. The most important producing centres are Mount Morgan, in Queensland; Mount Lyell, in Tasmania; Cobar, in New South Wales; and Wallaroo and Moonta, in South Australia; but copper is also found in many other districts of the four States mentioned. Extensive copper deposits have also been discovered in West Australia and Victoria, but these have not as yet been exploited. Almost the whole of the copper production of Australia in 1907 was exported, and more than half (about £2,000,000) was taken by Great Britain. Other buyers were the United States (about £700,000), Belgium (about £300,000), China and Germany (about £150,000 each), and France and India.

Later in his report, the Consul states that electric lighting materials were imported in 1908 to the extent of £340,000, of which £233,500 was from Great Britain, £34,500 from Germany, £34,000 from the United States, and the remainder from Italy, France, Denmark and Austria. British goods are admitted free of duty, whereas other goods are liable to a duty of 5 per cent. *ad valorem*. Telephone apparatus and metal parts for electrical apparatus were imported to a value of £410,000, of which £195,600 was from Great Britain, £118,000 from the United States, £54,500 from Sweden, £27,200 from Germany, £6,200 from Belgium, £4,000 from France, and the remainder from Italy, Holland and Austria-Hungary. Gas and petroleum motors and traction engines were imported to a value of £396,000, of which £292,000 was from Great Britain, and £87,300 from the United States, the remainder being from Germany, Sweden and France.

Greece.—An article, based on a report of the Belgian Legation at Athens, appears in the *Bulletin Commercial* (Brussels) of May 15th, directing attention to the increasing demand in Greece for all kinds of electrical appliances and material, foremost among which are mentioned—underground insulating copper cables, insulating wire for houses and aerial lines, high and low-tension porcelain insulators, dynamos and electric motors, transformers, measuring instruments, electric carbon, &c. It appears that the Hellenic Electrical Co. alone imports over £12,000 worth of material per annum.—*Board of Trade Journal.*

The Charge of False Pretences.—William Parkinson has been committed for trial at the Lancaster Assizes on the charge of obtaining money by false pretences, referred to last week.

Spain.—The report by the British Vice-Consul at Gijon (Mr. A. Lovelace) on the trade of that district in 1908, which will shortly be issued, states that electrical machinery is being imported in increasing quantities, Germany being the principal source of supply. Two German firms have established themselves at Gijon with considerable staffs of German employés. The ELECTRICAL REVIEW has done its best to persuade British manufacturers to study the electrical needs of Spain.

Mine Development.—Mr. D. Burnett, the new general manager of Pigg's Peak Development Co., Ltd., has recommended that in view of recent developments the capacity both of the mill and the electric plant be increased at an estimated cost of £15,000. The present plant is capable of treating up to 30,000 tons of ore per annum.

Catalogues and Lists.—MESSRS. W. & R. JACOBS, 39c, King William Street, E.C.—8-page illustrated catalogue, showing a variety of attractive electric light shades, and giving prices of same. A loose list draws attention to the low prices of the "Bell" shade for Osram lamps.

MESSRS. JULIUS SAX & Co., LTD., 90-100, Charing Cross Road, W.C.—Well prepared catalogue of 44 pages, the contents consisting of fair-sized illustrations and notes of prices of electric light fittings, which have been specially designed for use with Holophane glassware. These include Reflector bowl, Holophane sphere, pendant and ceiling fittings. Metal-filament lamps with Holophane globes are claimed to give very effective illumination. Readers can see any of the fittings by visiting the show-rooms at the above address.

MR. GEORGE ELLISON, 17 and 18, Warstone Lane, Birmingham.—Sheet No. 90, giving illustrated particulars of automatic release starting gear for A.C. motors.

THE SUN ELECTRICAL CO., LTD., 118 120, Charing Cross Road, W.C.—Leaflet illustrating the "Bouverie" indicating bell push, a new type just being placed on the market. A small buzzer is accommodated in the base, and connected in series with the line, so that the buzzer vibrates synchronously with the bell, giving a reliable indication of its working, and also a warning when the batteries are becoming discharged.

MESSRS. T. W. BROADBENT, LTD., Huddersfield.—Leaflet describing their "D" type continuous-current machines (open), "F" type shunt regulators, and "S" type switches, and giving prices of same.

MESSRS. SIEMENS BROS. & Co., LTD., Caxton House, S.W.—Illustrated reprints relating to their "O-S" wiring system.

MESSRS. KRUPKA & JACOBY, 11, Queen Victoria Street, E.C.—Several new leaflets relating respectively to H.V. tantalum lamps, high-efficiency auto-transformers, and 600 and 2,500-megohm rubber-covered wires.

THE POWER PLANT CO., LTD., West Drayton.—Leaflet describing and illustrating their new flexible insulating reversible couplings, and giving dimensions, weights and prices of same.

MR. H. C. SLINGSBY, 142/146, Old Street, E.C.—8-page illustrated pamphlet (No. 105) relating to the Slingsby steelback patent extension ladders.

MESSRS. J. H. HOLMES & Co., 17, Soho Square, W.—Neat booklet containing general description with illustrations of the Holmes-Clatworthy patent system for driving rotary presses by electricity. The pictures show electrically-driven machines in position in several London and provincial newspaper and magazine printing establishments. Some useful general information for engineers, directions for motor attendants, and memo. pages, appear at the end.

THE "ACME" METER CO., 46, Queen Victoria Street, E.C.—A number of new leaflets have been issued as follows:—One giving opinions of tramway managers concerning the advantages of meters for cars; a list of tramways using "Acme" time meters; a leaflet relating to bonus systems (reprinted from the ELECTRICAL REVIEW); specimens of cards for control of drivers by time meters; price lists of "Acme" time meters of single and double types.

MESSRS. O. C. HAWKES, LTD., Birmingham.—A new illustrated circular is just being issued in which the Hawkes electric cabinet baths are described.

Book Notices.—"The Nurnberg Gas Engine." By R. Bechtel. Reprint of Paper read before the Birmingham Institute of Mechanical Engineers. Wellington: From the author.

Construction des Induits à Courant Continu, Coussinets, Paliers, &c. By E. J. Brunswick and M. Aliamet. Paris: Gauthier-Villars, Masson & Co. Price 2 fr. 50 c.—This little book is the fifth of a series by the same authors dealing with various points in the design and construction of direct-current armatures. This particular volume goes in considerable detail into the question of bearings, both ordinary and ball-bearing brackets and supports, lubrication, pulleys, transmission belts and ropes, &c. The treatment is simple, and many useful practical hints are scattered through the pages; but a good many allied subjects, notably toothed and worm gearing, are not touched upon. A number of useful tables as to permissible loads on bearings, power transmitted by various belts, &c., are given. The book concludes with a discussion of the application of a weighted jockey pulley to belt driving, devised by Capt. Leneveu. Examples of the successful use of this simple arrangement for quite short drives with high-speed ratios up to about 25:1 are given.

"Schutz der Hochspannungsanlagen." By H. Zipp. Hanover: Dr. M. Jänecke. 1909. Price M. 3.

"La Pratica delle Construzioni Elettromeccaniche." By G. Pardini. Milan: E. Bignami & Co. 1909. Price L. 4.

"American Institute of Architects' Quarterly Bulletin." Vol. IX, No. 4. January, 1909. Washington: The Institute.

Liquidation.—THE CONDUIT AND INSULATION CO., LTD. (in liquidation).—The liquidator (Mr. Charles J. March) has issued a statement of receipts and payments. The business was continued until October, 1908, with a view to the company being reconstructed or the factory sold as a going concern, but all efforts having failed, the stock and machinery were sold by public auction. No offer was received for the buildings or the lease of the premises. The receipts have been £2,603, including £25 profit on trading (receipts under this head were £2,275 less payments on account thereof £2,250). The payments for law, auctioneer, and other charges, including £315 for liquidator's remuneration, were £641, plus £167 to preferential creditors, £660 to debenture-holders for principal and interest, and £100 paid on surrender of lease. The unsecured creditors now receive a second and final dividend of 3s. 3d. in the £, making 8s. 3d. This final dividend was payable by Mr. March as from June 9th.

Large Cable Contract.—The cables for the lighting and tramway systems of the city of Bahia Blanca, Argentine Republic, comprise 83 km. of high and low-tension paper-insulated feeder and distributor cables, 38 km. of low-tension vulcanised bitumen insulated tramway and telephone cables, and 8,000 metres of vulcanised rubber insulated cables. The whole of these cables, as well as the troughing, are being supplied by MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., who will also effect the laying and fixing, and will supervise the work during the

installation of the complete network. For the greater part, the cables will be laid in earthenware troughing filled with refined Trinidad bitumen, and covered with earthenware tiles, the total length of troughing required being about 100 km. The house services will be tapped off the distributors by means of specially designed porcelain boxes provided with spigot and socket ends which fit into the troughing. A continuous run of earthenware covering is thus effected, and no part of the main cable is left exposed, these precautions being necessitated by the water, which occasionally floods the streets of Bahia Blanca to a depth of 3 ft. for long periods. About 750 service boxes will be supplied, and an equal number of house disconnecting fuse-boxes, also of special design. The total value of this work is valued at between £40,000 and £45,000.

Bankruptcy Proceedings.—ARNOLD ROBERTS, electrical engineer, 21, North Parade, Bradford.—July 3rd is the last day for the receipt of proofs for intended dividend by the trustees, J. H. Haley, 29, Tyrrel Street, and R. A. Vintner, King's Arcade, Bradford.

B.T.-H. Mercury Meters.—The Edinburgh and Glasgow Corporations have placed orders with the BRITISH THOMSON-HOUSTON CO., LTD., for part of their yearly requirements in mercury meters. The makers claim that this meter has a characteristic curve which closely approximates a straight line from the lowest load to full load, the meter starting easily with a load equal to ½ per cent. of its rated capacity. These meters have also a very high ratio of torque to weight, and there are no hysteresis errors and other troubles owing to there being no compounding.

Trade Announcements. — MR. ARTHUR TERRY (Mannheim India-Rubber, Gutta-Percha and Asbestos Works Co., Ltd.) has removed to more commodious offices and stock rooms at 61, Leadenhall Street, London, E.C., where he will carry larger stocks. A new price list of ebonite goods, insulating tapes, &c., has just been issued.

THE DAVIS ELECTRICAL CO., LTD., of 17, Moor Street, Cambridge Circus, W., have taken over additional premises at 90, Charing Cross Road, and New Compton Street, W., where they have fitted up an electric fittings and appliances showroom for the trade and electrical contractors.

MESSRS. OZONAIR, LTD, have taken larger premises, as offices, showrooms, &c., at 96, Victoria Street, Westminster, to which address they will remove on June 24th. After that date their telephone number will be "Victoria 12." A new list regarding the Ozonair apparatus and some important installations thereof, has been received. It shows some portable types, and gives prices of same.

MESSRS. VERITYS, LTD., notify us that their Bristol office and warehouse have now been moved to 59, Victoria Street, Bristol. Mr. A. H. Dowson, who has been with the company for many years, remains in command.

THE ACCESSORIES MANUFACTURING CO., LTD., announce that in order to further extend their business, they have disposed of their present premises, 9 and 10, Wells Street, W., and have acquired more extensive premises at 11, Dean Street, Oxford Street (Soho), which will be ready for business purposes on Monday next, June 14th.

Electrical Imports and Exports for May.—The B. of T. returns, as published in the daily Press, show decreased imports and increased exports as follows, for electrical lines:—

Imports.—Electrical goods £85,469, against £97,455 in the same month of last year; decrease, £11,986.

Exports.—Electrical goods £162,784, against £150,040 in the same month, an increase of £12,744.

LIGHTING and POWER NOTES.

Atherton.—Negotiations have been opened on behalf of the Laburnum Spinning Co. with the local D.C. for taking a supply of electricity for their new mill adjoining Atherton central station.

Barrow-in-Furness.—The local Chamber of Trade has asked the Corporation whether the latter sells or lets out on hire, for subsequent sale or otherwise, electric lamps, fittings or electric apparatus—such as motors and apparatus for electric heating or cooking purposes—and also whether it has obtained any authority to enable it to legally engage in this trade (if any) either under the E.L. Act, 1882, or by subsequent prov. order or special Act of Parliament, and consideration of the reply from the Corporation has been deferred.

Alderman Smith, at the Council meeting on Monday, said that the capital account during the past year had been increased by only £2,000, the total capital expenditure being £111,300. In 10 years they had repaid £22,000, leaving a balance of £91,000. Despite bad trade and other depressions during the past 12 months, there had been an increase of revenue of £500, whilst expenses had increased by only £150. The gross profit was a little over £600 better than in the previous year, being £6,615, as against £5,998, and £600 was equal to 7¾ per cent. Unfortunately, they were faced very heavily by interest and sinking fund, owing to the short periods in which loans had to be repaid, and the whole of the £6,615 was swallowed up with the addition of £383 in meeting these charges for the 12 months. There were 152 motors connected. Though the report was disappointing in some respects by reason of their not having during the 10 years been able to place anything to a guarantee or emergency fund, they had not made a call on the rates and had paid off £22,000. He believed they had a concern which, if they wanted to part with it, would bring in a very considerable sum in excess of its cost to them.

Beckenham.—On Monday the Council adopted a report of the Electricity Committee recommending the immediate extension of the economiser (£232), and the construction of coal bunkers (£146).

A discussion on free wiring agreements arose at the U.D.C. meeting on Monday, on a recommendation from the Electricity Committee that an offer of an owner to enter into an agreement for a definite term of five years be agreed to. Some time ago the agreement in force throughout the district was altered to 10 years, although it was pointed out at the time that the period was absurdly long. It was now sought to make an exception, but it was held that to be consistent the Council must fix the period at either five or ten years, or whatever might be thought proper, instead of having these exceptions. In the end the whole matter was referred back to the Committee for re-consideration on the lines suggested by the discussion.

Belfast.—At the weekly meeting of the Tramways and Electrical Committee it was reported that, as a result of the electric lighting experiments at the Castle Junction, it was found very much superior to gas lighting; that part of the city is, therefore, to remain so lighted. It was decided that the control of the overhead equipment of the tramway system should be solely in the hands of the electrical engineer and his staff.

Bradford.—The minutes of the Bradford Gas Committee, which came before the City Council on Tuesday, contained the following interesting resolution: "That, for the present, no canvassing shall be done by either the gas or the electricity departments, one department against another, in any district where there are now gas mains or electricity cables, but that where applications are received for a supply of either electricity or gas, the department shall be at liberty to canvass for customers on giving notice of such intention to the other department; both the above clauses not to affect canvassing for power purposes where the other department is not affected."

Bury.—In his annual report the borough electrical engineer states that, after payment of all working expenses, there was a gross profit of £8,990, equal to 9·7 per cent. on the average capital employed, compared with £9,511 on the capital for the previous year; £6,077 is required to pay interest on loans and sinking fund, leaving a net profit of £2,914, equal to 3·1 per cent. on the average capital, to assist the rates and to add to the depreciation and reserve fund. A scheme is proceeding for constructing a new generating station, at a cost of £72,000.

Canterbury.—The accounts of the electricity undertaking for the year ended March 31st, 1909, just issued, show that £1,379 was expended on capital account out of loans, bringing the total to £66,379. The total of the loans repaid and sinking fund is £17,416, while the reserve fund stands at £3,038. The revenue (£8,766) shows an increase of about £70 on the year 1907-8. The units sold were 664,251, an increase of 2 per cent. The expenditure was £4,690, an increase of £68. After providing for interest, income-tax, capital repayment and sinking fund of £3,983, the net profit is £93, which, with the balance of £500 from last year, is carried forward. There are 646 consumers against 588 last year. Metallic-filament lamps have been largely used in the city, but, notwithstanding the reduced current used thereby, the accounts show a profit. The gross profit shows a return of about 6½ per cent. upon capital expended.

Chichester.—The electricity supply undertaking was formally inaugurated on June 3rd. Mr. Horace Boot, the consulting engineer, presided at the luncheon which preceded the ceremony.

Continental Notes.—SPAIN.—The *Gaceta de Obras Publicas*, the organ of the Spanish Ministry of Public Works, reports that the Spanish Government have been authorised to proceed with the execution of the works necessary for converting the Castilla Canal into an irrigation canal. The Government will utilise, to the best interests of the public, the motive power which it will be possible to obtain from the waterfalls in connection with the canal, and at the same time they will make fit for navigation such parts of the canal as can be best adapted for such a purpose, always taking into consideration the fact that the canal is primarily to be used for irrigation work.

BELGIUM.—La Mutuelle des Electriciens Belges is the title of a co-operative concern which has just been formed in Brussels to put down a plant for the generation of electrical energy and to supply the same for lighting and power purposes at the Brussels 1910 International Exhibition.

GERMANY.—The Prussian State Railway authorities have decided to put down an electric lighting plant at the railway station at Konitz, West Prussia.

Darlington.—A L.G.B. inquiry was held on June 3rd into the application of the T.C. for a loan of £3,900 for a 500-KW. turbo-generator.

Dundee.—Among the conditions in the agreement under which the Admiralty propose taking over the west graving dock, &c., for a submarine base, is that the Harbour Trustees shall light the enclosure with electricity.

Dunfermline.—The B. of T. has granted permission to Fife Electric Power Co. to erect an overhead wire from their works at Townhill to the Bleachfield, and provision will there be made for supplying current to the new tramway system. A cable is to be laid to Cowdenbeath for customers there, and it will be subsequently carried on to Lochgelly. Apart from these alterations, an extension of the company's plant at Townhill may be rendered necessary in the near future.

Eccles.—Tenders are to be invited for the provision and installation of water-softening and purifying plant at the electricity works. The coal required during the forthcoming year is to be purchased on a heat unit basis instead of by weight, and the services of a fuel expert are to be engaged to make the necessary periodical examinations as to the calorific value of the fuel. Mains are to be laid at an estimated cost of £288.

Glasgow.—Electrical machinery is making headway at Glasgow docks. For the new berthage at Yorkhill, Glasgow, the adoption of electric capstans has been decided upon. The working of these capstans at the new dock—Rothesay Dock—has proved thoroughly satisfactory; and the value of the electric coal hoists at the Rothesay dock is evidenced by the decision to erect other two hoists, one at £10,500, by a Hamburg company, and the other at £9,850, by a Scottish firm.

Hastings.—The Corporation has just decided to reduce its charges for electricity for power and heating from 3d. per unit to 2d. per unit, with a charge of 4½d. for cinematograph entertainments.

Ilkley.—The D.C. proposes to provide mechanical stokers and other improvements at the gas works, to remove the Town Hall electric lighting plant to the gas works, and to lay a cable between the gas works and the Town Hall, so that the Town Hall electric lighting can at any time be extended to the principal streets of the town. The scheme is estimated to cost £5,700, and £1,155 of this is for electric lighting. A L.G.B. inquiry has been held respecting the Council's application for sanction to borrow the £5,700 required, and the reply received from the L.G.B. states that the Board approve generally of the proposed scheme for alterations and extensions to the gas works, but are not satisfied that the proposal to raise capital for the Town Hall electric lighting scheme is within the statutory powers of the Council.

Leeds.—The Street Lighting Committee has decided to substitute electric arc lighting for gas lighting in Aire Street (six lamps), Whitehall Road (25), Kirkstall Road (22), Central Road (four), subway from Whitehall Road to Gildred Road (four). In connection with the removal of the tramway poles in Boar Lane, to which electric arc lamps were attached, the Committee has decided to take advantage of these alterations to install an improved type of arc lamp.

London.—SOUTHWARK.—The Electricity Committee has decided in favour of a new battery room being built adjoining the station, large enough to accommodate in one tier a battery of a capacity of 1,540 ampere-hours. Estimates are to be obtained for installing and maintaining the proposed battery for a period of 15 years at an annual inclusive charge. The cost of the building is estimated at £900. The Board of Trade have written in reply to an inquiry by the Council, stating that the Board are advised that the Electric Lighting Acts (Amendment) Bill, as amended in the House of Lords, will not override or limit any special provisions in local Acts empowering local authorities to supply electrical fittings.

HAMPSTEAD.—Twenty-four incandescent street gas lamps are to be converted to incandescent electric lamps. The estimated saving is 4s. 6d. per lamp per annum.

BATTERSEA.—The Lighting Committee has prepared a scheme for providing consumers, at an estimated cost of £1,500, with arc lamps and motors, and the wiring of premises therefor (*a*) on the cash purchase-system; (*b*) on the hire purchase-system. The Electrical Trade Union has written to the Committee protesting against the action of the Committee in proposing that the work of wiring be, in the first instance, carried out by contractors.

PADDINGTON.—The Guardians have prepared a statement showing the cost of gas and electric light in the several establishments during the last ten years. In 1899-00 £754 was paid for gas and £245 for electric light. The figures for succeeding years were as follows:—1900-1, (*a*) gas £779, (*b*) electric light £431; 1901-2, (*a*) £794, (*b*) £478; 1902-3, (*a*) £731, (*b*) £533; 1903-4, (*a*) £819, (*b*) £540; 1904-5, (*a*) £765, (*b*) £515; 1905-6, (*a*) £733, (*b*) £471; 1906-7, (*a*) £805, (*b*) £507; 1907-8, (*a*) £802, (*b*) £554; 1908-9, (*a*) £740, (*b*) £617.

HACKNEY.—The Electricity Committee reporting upon the Electric Lighting Acts (Amendment) Bill, 1909, and the amendment thereto made at the instance of Lord Avebury, states that Hackney is not directly affected by this amendment, as it obtained its powers to spend money upon wiring and fittings in consumers' premises by the L.C.C. (General Powers) Act, 1906. In the interests, however, of local authorities possessing electricity undertakings outside the Metropolis, the Committee thinks that the amendments to the clause should not be allowed to stand. In practice, Hackney Council, although having the power to undertake this work directly, employs contractors, and the Council is able to do this by the fact that if the price charged by the contractors is prohibitive, the Council has the alternative of dispensing with them. The knowledge of this makes the contractors tender at reasonable prices. If the Councils, however, have not this power in reserve, it is obvious, especially in smaller towns, that the local authority will be in the hands of a ring of contractors, and consequently the consumers must suffer from the increased prices which may be charged. The Committee has communicated with the local Members of Parliament asking them to support the striking-out of the amendment when the Bill comes up for second reading.

ISLINGTON.—The Electric Lighting Acts (Amendment) Bill has been under the consideration of the Parliamentary Committee, especially as regards Clause 1, which provides that the Board of Trade may by provisional order authorise any local authority, company, or person, who is authorised by the same or any previous provisional order, or Act of Parliament, to supply electricity in any area, to acquire compulsorily or to use for the purpose of a generating station any land specified in the order, whether situated within or without the area of supply, and in the case of a local authority whether within or without the district. Any provisional order made under this clause will incorporate the schedule to the Electric Lighting Clauses Act, 1899, Sec. 81 of which provides that nothing in the special order shall exonerate the undertakers from any indictment action or other proceedings for nuisance. The Council would only be affected if it were found necessary to apply for an order under the section referred to, but seeing that electric lighting undertakers are liable to heavy penalties for failure to supply, the Committee thinks it not reasonable that it should be subjected to any further liability than that which is imposed by the common law in the case of persons exercising statutory powers and duties. The Council has decided that a petition be presented against the Bill, in order to obtain, if possible, the suggested amendment.

Lyme Regis.—The inaugural ceremony of switching on the electric supply for the lighting of the streets was performed by the Mayor on June 1st.

Market Harborough.—The U.D.C. having taken a canvass of the area covered by the E.L. Order, has obtained the following results:—Willing to take a supply of electricity, 23; provisionally willing, 15; not willing, 342; replies not returned, 66. The Council has decided to ask for a further extension of time for carrying out the order.

Middlesbrough.—The E.L. Committee on June 3rd decided to apply to the L.G.B. for a loan of £18,922 for cables, &c., and in future to provide meters out of revenue.

Morley.—For the past year there is a gross profit of £280 on the electricity department, against £1,087 last year; but the payment of £2,078 for interest and sinking-fund charges and bank interest, against £2,004 last year, left a net deficit amounting to £1,799. In view of the almost universal use of metal-filament lamps throughout the borough, the Electricity Committee has decided to increase the price charged for energy used for lighting from 4d. to 5d. per unit.

Nova Scotia.—The Nova Scotia Legislature passed the following Bills during the session just closed: An Act to enable the town of Shelburne to acquire, install and operate an electric power and light system; an Act to enable the town of Glace Bay (this is where the Marconi wireless station is situated) to supply the town of Dominion with electricity; an Act to amend Chapter 117, Acts of 1899, entitled "An Act for supplying the Town of Liverpool with Electric Light"; an Act to incorporate the Cape Breton Electric Co., Ltd.; an Act to enable the Standard Drain Pipe Co., Ltd., to construct an aerial tramway over East River Road, Picton County; an Act to enable the inhabitants of Bear River to provide themselves with a system of street lighting; an Act to confirm the contract between the New Glasgow Electric Co., Ltd., and the Egerton Tramway Co., Ltd.; and an Act to incorporate the Yarmouth and Digby Electric Co., Ltd.

Oldham.—A L.G.B. inquiry was held on June 2nd relative to the application of the T.C. for a loan of £10,250 for mains (£8,000), services (£1,000) and meters (£1,250). There was no opposition.

Penrith.—The E.L. supply, provided by the Electric Supply Co., Ltd., was inaugurated on Friday, the current being switched on by Mrs. Fox, wife of Mr. Percy Fox, chairman of the company. There are already 40 consumers.

Portsmouth.—The total receipts of the electric light undertaking for the year ended March 31st were £48,631, and the total expenditure £24,449. The receipts were only £259 above those of last year, but this was due to the fact that last year was the first full period in which the reduction in meter rents and the scale of charges to large consumers took effect. The effect of the loss of £1,800 by the close of the Naval Barracks contract was also felt. It is considered very satisfactory, therefore, that the receipts have increased at all, although expenses have decreased by £2,189. After all charges have been met, there remains a balance of £4,022, from which the Committee proposes to devote £2,000 to the relief of the rates, to place £600 to reserve, and to use £1,300 for the payment for lamps for street lighting, which is considered a wiser course than borrowing the money for ten years. In the last four years the undertaking has contributed £11,000 to the relief of the rates, which is nearly equivalent to threepence in the £ on the ratable value.

St. Helens.—A considerable increase in the amount of energy sold is reported in the annual statement. The total income amounted to £19,533, an increase of £285, and the cost of production was reduced from ·81d. to ·77d.

Salford.—The T.C. has applied to the L.G.B. for a loan of £3,000 for the extension of the E.L. mains to Prestwich, and £6,500 for the installation of a battery sub-station at the Frederick Road Station.

Sheffield.—The following works are to be carried out:—Extending feeder from Chapel Lane sub-station to Weeden Street, cost £959; extension of mains in Attercliffe Road to Messrs. J. Shipman & Co.'s, £134; in Abbeyfield Road to Mr. J. Wright's, £68; in Banner Cross Road for 20 new houses for Messrs. S. Walker & Son, Mr. J. A. Wragg and Mr. W. Saunderson, £198; in Stalker Walk and Stalker Lees Road for Mr. J. F. Eardley, £108.

South Africa.—EAST LONDON.—The electrical engineer recently reported that the annual loss on the electrical department, which three years ago was over £12,000, had now been reduced to £5,700. On lighting the loss three years ago was nearly £4,000, but this has now been converted into a net profit of £3,500. During the last three years the revenue of the whole department has decreased by £7,900, and the expenditure has been reduced by £16,200.

DURBAN.—The Corporation has just increased the plant at its electric power station by the addition of a combined A.C. and D.C. high-pressure Parsons turbo-generator, at a cost of £5,240. The D.C. generator has a capacity of 750 KW. at 550 volts; the A.C. generator has a capacity of 200 KW. at 2,750 volts 62 cycles, and is wound for two-phase working, though as yet single-phase only is used. The turbine is capable of dealing with an overload of 20 per cent., and runs at a speed of 1,860 R.P.M., with a steam pressure of 150 lb. per sq. in. and 27 in. vacuum. It exhausts into a surface condenser of the vacuum-augmentor type, fitted with electrically-driven three-throw air pumps and centrifugal circulating pump. At a recent meeting of the Council a report was submitted by the borough electrical engineer on a scheme for assisting private householders in the wiring of their premises, and his proposals were adopted.

TRANSVAAL.—The *Board of Trade Journal* states that a Commission has been appointed to inquire into the desirability of the establishment of large electric power companies in the Transvaal, and the probable effect of such companies on the Witwatersrand gold industry, the coal industry, the Central South African Railways, agriculture and irrigation, the employment of labour, &c.; also into the attitude of the State towards such companies.

Swansea.—The annual report shows that the number of consumers on the books increased during the year from 1,162 to 1,379.

Tasmania.—LAUNCESTON.—*Australasian Hardware and Machinery* states that metal-filament lamps, radiators, and irons are in use in the city, the two last-mentioned appearing to be more extensively used there in proportion to the population than anywhere else in the Commonwealth.

Venezuela.—A new concern has recently been formed in Valencia, with a capital of £20,000, and the title La Compania Electricidad de Valencia, to supply that city with electrical energy for lighting and power purposes. Certain available water power, situated about 25 miles from Valencia, is being utilised to generate the current. The necessary plant has been ordered from Germany and Switzerland, and the bulk of it has already arrived in Venezuela. Although some difficulty has been experienced in getting it to the up-country location, owing to the absence of roads, the work of construction is well in hand, and those responsible for the undertaking hope to have it in operation by the end of the summer.

Wakefield.—A L.G.B. inquiry has been held regarding the proposal to borrow £615 for transformers. £390 is required for 60-KW. transformers estimated to be sufficient for the requirements of the next two years, and £225 for 150 consumers' transformers, estimated to last about three years.

Walkden.—Current has been supplied this week to Messrs. E. Lane & Son's Hope Mills, by the Lancashire Electric Power Co.

Wallasey.—A tender for the extension of the engine house at the electric supply station, at £549, has been accepted by the D.C.

West Bromwich.—In the annual report of the Corporation's electricity undertaking, it is stated that during the year the sales of electricity for traction amounted to 922,516 units, a decrease of 88,359; for lighting purposes 287,222, an increase of 3,765; for power purposes 700,543 units, an increase of 278,643; for public lighting 101,704 units, a decrease of 6,951; the total sales being 2,011,985 units, against 1,824,887, an increase of 187,098. Notwithstanding a bigger decrease in the traction supply than has been experienced hitherto, there was a net increase in the sales of 10·2 per cent., against an increase of 1·42 per cent. in the previous year. The increase in the sales for power purposes was the largest experienced in any year since the inception of the undertaking, and the action of the Committee in giving manufacturers the benefit of cheap rates for power purposes has been more than justified by results. The borough engineer urges that low prices would foster a good day load with consequent improved load factors and decreased works cost, and even at the low rates suggested it would be profitable. The total number of units generated during the year was 2,489,618, an increase of 309,222, or 13 per cent. over that of the previous year. The units lost in distribution, or otherwise, unaccounted for were 260,652, equal to 10·4 per cent. of the quantity generated, an increase of 1·8 per cent. compared with the previous year. There has been a net increase of 20 consumers during the year, and the total costs per unit showed a decrease of 1d., equivalent to a saving of £840 upon the total units sold. The borrowing powers have been increased during the year by £2,000, and the total loan debt on March 31st, 1909, was £67,422. Capital expenditure amounting to £2,369 had been incurred during the year, and the total expenditure on capital account amounted to £73,699. The total expenditure on the trading account was £6,740, against £6,915 the previous year, a decrease of £175. The gross profit on the trading account was £6,856, compared with £6,057, an increase of £799. The net profit realised on the sale of energy alone was £2,602. The balance of profits, £988, has been applied to a new account for the purposes of development and depreciation.

Worcester.—The T.C. has been recommended to continue the use of electricity for pumping at the waterworks until such time as the Electricity Committee can find as good or better customers for the surplus electric power at the Powick Works.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The tramway traffic receipts for the year ended last Monday total £70,744, a decrease of £334 compared with the preceding 12 months. The number of miles run was 1,558,978, a decrease of 12,140.

Accrington.—The tramway deadlock at Accrington and Rawtenstall is still in existence. It is estimated that each municipality is losing £300 per year in traffic receipts. The facts of the case are these:—Accrington, who supply the current and cars for the running of the Haslingden system, have been unable to come to terms with Rawtenstall for a through service from Accrington. The result is that passengers by the new electric cars between Haslingden and Rawtenstall (which towns are only 2 miles apart) are compelled to change at Lockgate, the boundary between the two towns. As the cars do not run in connection, a loss of receipts is caused. With a view to relieving the situation and effecting a settlement of the question, the Haslingden Town Council is now endeavouring to bring about a conference with the Corporations of the three towns interested.

Australia.—NEW SOUTH WALES.—In his report the Chief Commissioner, Mr. T. R. Johnson, M.Inst.C.E., for the first quarter of 1909, states that the tramways worked chiefly by electric traction have a total length of 148½ miles. The revenue for the quarter amounted to £285,099, an increase of £20,781 compared with the corresponding period of the previous year. The expenditure, amounting to £215,631, showed an advance of £19,375. The number of passengers carried was 48½ millions, an advance of 3½ millions. The percentage of expenditure to earnings was 75·63. The Government is pursuing a progressive tramway policy, and during the quarter seven different extensions were opened for traffic, adding 14 miles 13 chains to the system.

Birkenhead.—Instead of an anticipated surplus on the year's working of the Corporation electric tramways of £424, there is £909 chargeable to the rates, the deficit being £1,300.

Bolton.—The Council has approved of the proposal for through running arrangements between the South Lancashire Tramways Co.'s system and Bolton Corporation system, between Bolton and Clifton and Bolton and Lowton.

Burnley.—The working of the tramways for the year ended March 31st shows a decrease of £2,901 in net income. For the first time something (£2,381) has been voted from the borough fund after placing £6,000 to reserve. The total capital expended to date has been £193,196. The average cost per car-mile for traffic purposes was 2·844d., against 2·757d. in the previous year, and the total cost per car-mile, including general expenses, repairs and maintenance, &c., was 7·995d. against 7·924d.; £21,718 has been carried to net revenue account. The income for the year was £62,669. The passengers carried were 12,176,782—a decrease of 179,176. There was an increase of 26,894 car-miles run. The consumption of energy showed a decrease of ·01 unit per car-mile.

Mr. H. Mozley, manager, mentions in his report that a trial has been given to the Simpson & Park radial trucks in place of four-motor equipments. They were abandoned, however, and the trucks converted into simple pony wheel trucks with a new arrangement of carrying body springs. The result was satisfactory, and 20 per cent. less energy was used, representing a large sum per annum. Mr. Mozley complains of the absence of a proper check upon the consumption of energy. "When it is remembered that energy costs about £15,000 per year, and last year was 34 per cent. of the total working expenses, the importance of this defect becomes apparent." In the absence of watt-meters, time meters have been used in Burnley with some degree of success

Conway.—The T.C. has decided to give every assistance to the Llandudno and Colwyn Bay District Tramway Co. in carrying out the proposed extension of the tramways to Deganwy.

Continental Notes.—GERMANY.—Some particulars have just been published concerning the terms under which the State of Hamburg has undertaken to lease the city and suburban electric railway built for the account of the State by the Siemens & Halske Co. and the A.E.G. According to the agreement, these two firms have to form a company with a capital of £750,000 which can be divided into ordinary and preference shares, and the company itself is to establish the power station on a site granted by the State on payment of 4 per cent. of the site value. The passenger fares for third class range from 1½d. to 2½d., the former charge prevailing for early morning tickets. The share of the State in the company's receipts will amount to from ½d. to 1½d. per ticket issued, 10 per cent. of the income from season tickets, and two-thirds of the net profits after the payment of a dividend of 5 per cent. on the share capital and the fees of the directors.

Plans are being prepared in respect of a projected electric tramway between Kosen and Naumburg.

Edinburgh.—The Road Board has discussed the subject of railess electric traction, and has advised the Tramway Committee that as there is no experience of the new system in the country, there are not sufficient data to warrant an expression of opinion generally. The Board thought the adoption of the system would involve considerable increase in the cost of maintenance of the roads and might prove a source of danger to the public using the roads. The Committee adjourned the discussion of the matter till next meeting.

Egypt.—A new electric tramway has just been completed and opened for traffic between Heliopolis and Koubbeh, a distance of 1½ km., by the Cairo Electric Railways and Heliopolis Oases Co.

Erdington.—The U.D.C. has applied to the B. of T. for a further extension of time until 1914 for completing the works authorised by the Tramway Act, 1902.

Glasgow.—Detailed statistics are now published in connection with the traffic receipts of the T.C. tramways for the past financial year. These show that the average track mileage open during the year (single) was 180½ miles, an increase of 2½ miles; car-mileage run was 20,802,797 miles, an increase of 36,075 miles; traffic receipts amounted to £889,531, a decrease of £17,964; the traffic receipts per car-mile were 10·262d., a decrease of ·226d.; traffic receipts per passenger ·963d., an increase of ·003d.; passengers carried 221,744,569, a decrease of 5,203,721. The numbers of passengers carried at each fare were:—½d., 62,165,793; 1d., 132,276,804; 1½d., 17,359,841; 2d., 5,307,815; 2½d., 2,210,325; 3d., 1,261,833; 3½d., 984,254; 4d., 177,899. Since the beginning of the year on June 1st, 1908, a number of extensions have been opened for traffic; these were Burnside, Dalmuir, Bilsland Drive and Thornliebank. The total length of these extensions is 5·31 miles of route.

In connection with the suggested direct car service between the east and the west end of the city, it is stated that Mr. Dalrymple, the tramways manager, has informed his committee that the proposed service from Alexandra Park to Hillhead or Partick would involve a loss to the department of £11,000 per annum. The running of the direct service demanded by Townhead folk could only be done by diverting cars from another route, and Mr. Dalrymple does not think there is sufficient east and west traffic to make the service pay.

Halifax.—On 20th ult. Major Druitt held a B. of T. inquiry respecting the application by the Corporation for sanction to a double tramline in Northgate, between Broad Street and Woolshops, and the laying of a single line in George Street. There was considerable opposition. The town clerk said the question had been repeatedly considered by the Town Council, which had come to the conclusion that the work had better be done. Councillor Spencer (chairman of the Tramways Committee) said the only serious objection was from shopkeepers along the route, but the municipality had to consider the ratepayers at large. Mr. Richardson (tramway manager) gave evdence, stating that the double line would greatly facilitate tramway traffic in that part of the town. The Corporation also asked for sanction to lay a double line in Orange Street.

Kirkcaldy.—The Kirkcaldy and Dysart Committee have conferred regarding the extension of the tramway system to Dysart, the latter committee agreeing to the terminus proposed by the former. Dysart will pay £150 per annum, the agreement to be subject to revision in five years.

Leeds.—The delegates who went to the Continent to inspect various systems of railless trolley traction in vogue there have made a lengthy report, which is now available. They inspected three methods—Mercedes Stoll, at Vienna; Filovia, at Milan; and the Max Schiemann, at Mulhausen, Alsace. They recommend that a system of railless track should be adopted in Leeds for the district between the city and Farnley, instead of putting down electric tramcars, and that the necessary powers should be obtained to carry this into effect. They do not suggest which is the best form of traction, but believe that a selection can be made which will serve the purpose of the Corporation. The Tramways Committee has approved the report and conclusions of the deputation, which comprised Mr. R. A. Smithson (chairman of the committee), and Mr. E. Matheson (deputy-chairman), Mr. J. S. Hinchcliffe, and Mr. J. B. Hamilton (general manager).

Kingston.—On the 1st inst., says the *Standard*, an electric tramcar running between Surbiton and Kingston had reached the top of Kingston Hill when the brakes failed to act, and the car began at once to descend the hill. Three passengers, in their fright, hastily jumped off the runaway car and received slight bruises and cuts. The car was stopped about half-way down the hill.

Leeds to Bradford.—This tramway service, with cars running every ten minutes, was inaugurated on 7th inst. Leeds and Bradford each put an equal number of cars on the nine miles' route on Monday. The Lord Mayor of Leeds drove a decorated car over the boundary into Bradford, and the Bradford Lord Mayor drove a similarly decorated car in the opposite direction.

Nottingham.—It is reported that, during the past year, nearly 34,000,000 passengers were carried, and after deducting working expenses, there remained a surplus of £56,767. £15,400 of this has been put in aid of the general district rate. The gross profits of the electricity undertaking are reported as £46,513.

Radcliffe.—At the Bury T.C. on the 3rd inst., it was stated that there had been a loss of £1,908 on the Radcliffe section of tramways, which was charged to the borough rate, and £620 was placed to credit, so that the amount abstracted from the rate was £1,287. The amount taken out of the borough fund for deficiencies on the Radcliffe tramways now amounts to £6,314 exclusive of interest.

Rochdale.—During the past year the Corporation electric cars have carried 10,247,338 passengers and run 1,248,362 miles. Average journeys per head of the population, 99·85; average revenue per car-mile, 11·01d.; working expenses, including power, were 6·28d. per car-mile. The gross capital expenditure on the system amounts to £348,510, and the unexhausted borrowing powers now represent £8,500.

Salford.—The Tramways Committee has withdrawn its offer to the Eccles Corporation to run motor-cars to the Courthouse at Worsley. The town clerk of Salford states that the terms suggested were "subject to an agreement being arrived at with regard to the opposition by the Eccles Corporation to the Salford Corporation," and that "it was distinctly understood that all the outstanding differences on the Bill and the tramways should be settled together, but as the Eccles Corporation have strenuously opposed the Bill, the sub-committee are not prepared to submit to the Town Council the terms suggested for the settlement of the action." The Eccles authority denies that any such condition as that mentioned was attached to the offer.

Sheffield.—Notices are to be served on the owners and occupiers with reference to the proposed doubling of the tramway track on the Darrell route, and on the Norton Woodseats section.

South Anglesey.—The Carnarvon Harbour Trust has decided to give its moral support, but no financial guarantee, to the South Anglesey Light Railway scheme. Carnarvon T.C., however, has decided to take steps to oppose the scheme in order to secure clauses to safeguard the interests of the town.

U.S.A.—PHILADELPHIA.—It is stated that the 10 days' tramway strike here cost £15,000 per day. The new basis of wages is 11d., instead of 9d. per hour, with a 10-hour day.

Warrington.—On the tramway undertaking during the past year, the gross profit amounted to £8,124, against £8,346 for the preceding year. After sinking fund and interest charges had been met, there was a net profit of £2,370, against £2,579 last year. In the electricity department, the gross profit was £6,739, against £7,533 for the preceding year. After paying loan charges amounting to £5,796, there remains a profit of £942, against £2,214 for 1908.

Wimbledon.—It has been decided by the Council to oppose an application to the Board of Trade made by the London United Tramways Co., for leave to increase the speed of their cars over a portion of the system from 14 to 16 miles an hour.

Yeadon.—Representations have been made asking for a reduction of the workmen's fares from Leeds to Yeadon from 5d. to 3d. It was pointed out in an interview by Mr. Hamilton, general manager of the Leeds Tramways, that there was to be a revision of the workmen's fares throughout the whole system, inasmuch as there was at present a loss of £9,000 a year on such fares.

TELEGRAPH and TELEPHONE NOTES.

Balloon and Telephone Wires.—On Tuesday the owner of a balloon was ordered to pay 16s. damages to the Postmaster-General, and costs, for breaking a number of telephone wires at Roehampton with his grappling iron.

Brazil.—The President, in his message to Congress last month, stated that arrangements were in progress for the duplication of the Amazon Telegraph Co.'s sub-fluvial cable between Belém and Manaos, to avoid the frequent interruptions in com-

munication. He referred also to a concession granted last year to the Felten & Guilleaume A.-G. for a new cable, to be put to work within 3½ years. A wireless station of high power is to be installed on the island of Fernando de Noronha, and another at Rio de Janeiro.

Cable-Laying Insurance.—The *Financial News* states that on Tuesday an important insurance, amounting to £185,000, was completed at Lloyd's in connection with the laying of 300 miles of cable from Newfoundland to join an existing Atlantic cable, and from Newfoundland to New York. The c.s. *Colonia*, belonging to the Telegraph Construction and Maintenance Co., Ltd., will shortly be dispatched from the Thames for the purpose. The total liability of underwriters in this venture exceeds £300,000, as the hull and machinery of the *Colonia* have been insured. So soon as submarine operations are commenced the responsibility of underwriters on the cable diminishes in the exact ratio as the cable is expended. As compared with ordinary marine insurance risks, those on cable are regarded as representing the highest class of insurance, as accidents are of very rare occurrence and the cable laying business, on the whole, has shown a very successful record.

Canada.—The Canadian Pacific Railway is erecting a direct wire, 971 miles long, between Winnipeg and Field, B.C., and one of 276 miles between Calgary and Cranbrook. The company is also undertaking the reconstruction of about 600 miles of line, and is extending in many other directions.

The Grand Trunk Pacific Railway Telegraph Department during 1908 erected a line of 675 miles of two wires between Winnipeg, Manitoba, Battle River and Alberta, and between Fort William and Lake Superior Junction, both in Ontario, a distance of 200 miles. Many lines will be erected during 1909 in various parts of Canada.

France.—Numerous cases are reported from France in which telegraph and telephone wires belonging to the State and to railway companies have been cut. In one instance the conductors of an overhead power circuit were tied together to cause a short circuit.

India.—According to the report on the progress of India just presented by the Indian Government to the House of Commons, the gross receipts of the telegraph system for 1907-8 exceeded those of 1906-7, the previous best on record, by £48,034, but the working expenses increased in a greater proportion, exceeding those of 1906-7 by £108,206. As a result the net receipts were £60,172 less, while the percentage of net revenue on capital outlay —which to the end of the year 1907-8 amounted to £6,857,048—fell to 1·80, the lowest figure recorded since 1878-9, the year after the department first showed a profit on its working. The large increase in working expenses was due to the increased cost of stationery and printing, to the inclusion for the first time of pensionary charges, to heavier repairs to lines, and to the increase in signalling and clerical establishments found necessary to cope with the increased traffic. The number of telegrams increased during the year by 11·99 per cent.; their value, however, increased only by 5·92 per cent. The increase was due to a normal increase in message revenue, to the Bazar Valley expedition, and to famine and consequent speculation in grain. Analysing the division of the traffic as between the State and private messages, the gross receipts from the former amounted to £114,978, and from the latter, to £553,909. The subscriptions to the Telegraph Department for telephone and similar services rendered during 1907 amounted to £21,714, being an increase of £3,945 over the figures of the previous year. The average annual subscriptions for the past five years amounted to £16,338. Interruptions during the year, on the lines to foreign countries, were somewhat more numerous than in 1906-7. The Raheng route to Bangkok was considerably improved, both on the Indian and Siamese sections, and it was now regularly used as an alternative when the Kanburi route to Bangkok was either blocked with traffic or interrupted. The traffic between India and Siam by these routes increased by 29 per cent. over the figures of the previous year. Wireless telegraphic communication between Diamond Island and Port Blair, Diamond Island and Bassein, and Calcutta and the Pilot Vessel at the Sandheads was maintained throughout the year. The traffic dealt with amounted to 17,069 telegrams, containing 479,437 words. On the system controlled by the Indo-European Telegraph Department, the gross earnings amounted to £109,002, being an increase of £6,328 over the previous year. Working expenses increased by £3,586. The capital expenditure amounted to £8,890, bringing up the total capital outlay to £997,094. The number of messages forwarded during the year amounted to 271,149, being an increase of 4·55 per cent. as compared with 1906-7. Under the joint purse agreement the share of the department was £4,575 more than the previous year, being £112,536 as against £107,961—principally due to the increase in traffic. The departmental receipts from the Australasian message fund for 1907-8 amounted to £5,984, being £32 less than in 1906-7, and a decrease of £251 on the receipts for 1899, on which the original Australasian message fund was based. Interruptions were not serious during the year. Acts of wilful damage, however, numbered 1,095, or 349 more than in the preceding year. These were largely due to the state of unrest and disorder which prevailed throughout the country generally, the insecurity of the roads necessitating an escort for those who had to travel. Several cases occurred of assaults and robberies of telegraph officials while on interruption or patrol duty.

New Microphone.—It is reported that two Swedish engineers, named Egner and Holmström, have invented a new microphone which doubles the speaking distance. According to the *Standard* correspondent, conversation with this system has been carried on between Stockholm and Berlin, a distance of 2,500 miles, as clearly as between Stockholm and Malmö.

Telegraphic Interruptions:—

Jamaica-Colon	May 6, 1909
Dakar-Conakry	May 13, 1909
Tangier-Cadiz	May 19, 1909
Cayenne-Salinas	June 7, 1909

Telephone Litigation in the U.S.A.—The decision arrived at in the action of the Western Union Telegraph Co. against the Bell Telephone Co. will soon be made known. Under their agreement of 1879 the latter company gave up the telephone business in lieu of a 17-year royalty on all telephones leased by the American Bell Co. The litigation has been in progress for nearly 10 years. The Western Union obtained a favourable decision from the United States Court of Appeals five years ago. The special master was appointed five years ago, but so complicated were the accounts and so extensive the investigations that it was only lately that he succeeded in reaching total figures. The Western Union claimed $12,000,000 to $15,000,000, while the Telephone Co. claimed that they had already paid the company too much under the contract. The amount of the award is $6,000,000.—*Montreal Gazette.*

Wireless Telegraphy.—We understand that the Admiralty have under consideration the desirability of modifying the height of wireless masts in cruisers and battleships. The present height of wireless masts is based upon original experiments with the greatest height that could be conveniently obtained—approximately 180 ft. The naval station at Rosyth, however, makes it desirable that this height should be reduced for the purpose of passing easily under the Forth Bridge. The height of the girders under which the masts have to pass is 140 ft., which would necessitate a reduction of about 50 ft. from the height of the mast; this would only give a margin of 10 ft. So far as the efficiency of the wireless installation is concerned, the reduction in height is not of so much importance as might at first sight appear. The tendency nowadays is more and more in the direction of roof aerials, which possess a marked sensitiveness in a fore and aft direction. With aerials of this description the actual height attained is less important than the mean height of the whole; in other words, the maximum height is less important than the average. The comparatively small amount cut off the top of the mast can therefore be to some extent compensated for by giving an increased spread.

The *Times* reports that the Admiralty is giving much attention to the development of wireless telegraph facilities on our coasts, particularly the east coast, where private enterprise has received little encouragement from shipping. Existing private stations will be utilised, and others erected at strategic points; though under Admiralty control, they will be open for private messages. The De Forest station at Cullercoats will be included in the scheme. The Royal Naval Volunteers will man the stations in time of war, when the regular staff will be required for service in the fleet, and arrangements will be made for their training.

It is reported that the military airship *Gross II* has just been equipped with wireless telegraph apparatus for the purpose of experiments. Special precautions have been taken to guard against causing by the electric discharges ignition of the hydrogen with which the balloon is inflated.

The wireless station at St. Patrick's Hill, near Pembroke, is rapidly nearing completion. The two masts which are to carry the aerial have been set in a direct line with the naval station at the Scilly Isles.

Wireless Telephony.—Lecturing at the Royal Institution last Friday, Prof. J. A. Fleming said that while the experimental results obtained in wireless telephony were extremely interesting, they had not yet passed into the stage of practical application, lacking the simplicity and certainty obtained with the Marconi system. He looked forward, however, with confidence to future developments in this direction.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—June 18th. Small steam and Duff coa for the Electricity Committee. Mr. J. A. Bell, city electrica engineer.

Amsterdam.—H.M. Consul at Amsterdam (Mr. W. A. Churchill) reports that the Noord-Zuid-Hollandsche Tramweg Maatschappij is increasing its capital by an issue of £270,000 in bonds, for improvements and the electrification of the tramways belonging to it. A copy of the prospectus (in Dutch) concerning the issue of the loan, and giving particulars of the improvements and works contemplated, may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Australia.—MELBOURNE.—July 14th. One direct-current steam-driven generating set of 1,000, 1,250 or 1,500 KW., for the Council. See "Official Notices" May 14th.

MELBOURNE.—150 relays, non-polar, for the Postmaster-General. See "Official Notices" May 28th.

MELBOURNE.—August 4th. Overhead travelling crane, for the Electricity Supply Committee. See "Official Notices" June 4th.

MELBOURNE.—August 4th. Overhead travelling crane for the Council. See "Official Notices" to-day.

Bedford.—June 26th. One 30 ft. × 8 ft. Lancashire boiler, with pipe work and superheater, for the Corporation. See "Official Notices" to-day.

Belfast.—Feeder panels for lighting switchboard in the Corporation electricity supply works. See "Official Notices" to-day.

Belgium.—June 18th. The municipal authorities of Hollogne-aux-Pierres (Liége) are inviting tenders for the concession for the public and private electric lighting of the town.

Burslem.—June 29th. One 600-KW. steam dynamo or turbo-generator; condensing plant, water-tube boiler, and switchgear, for the Corporation. See "Official Notices" to-day.

Carlisle.—June 14th. Stokers, superheaters, 300-KW. steam turbo-generator (D.C.), for the Electricity Department. See "Official Notices" May 28th.

June 11th.—Paper-insulated lead-covered cables for the Electricity Department. See "Official Notices" June 4th.

Clacton-on-Sea.—June 16th. Electric service fittings and joint-box compound, for a year. G. T. Lewis, Clerk to the U.D.C.

Devonport.—Direct-current meters, cables, oils, &c., for the Electricity Committee. See "Official Notices" June 4th.

Dudley.—June 18th. 10-H.P. motor, shafting and belting, for the Workhouse Laundry. Specification from the Clerk to the Governors, St. James' Road.

Eccles.—June 21st. Water-softening and purifying plant (3,000 gallons per hour) for the electricity works. Deposit one guinea to the borough electrical engineer.

Felixstowe and Walton.—June 21st. Cooling tower and tank, water softener and ventilating shaft, for the U.D.C. See "Official Notices" to-day.

Gillingham.—June 28th. Coal for the Council's Electricity Department. See "Official Notices" to-day.

Gravesend.—July 3rd. Automatic stoker for the Electricity Committee. See "Official Notices" to-day.

Halifax.—June 18th. Lead-covered and paper-insulated cable for the Corporation. See "Official Notices" to-day.

Ipswich.—June 23rd. Rubber-insulated wires and paper-insulated lead-sheathed cables for the Electricity Supply Department. See "Official Notices" to-day.

Italy.—It is announced in the *Board of Trade Journal* that tenders for the supply of electric lamps and lamp-holders for the Italian Royal Arsenals will be received up to June 21st by the Ministry of Marine at Rome. The upset price is £6,000, and the qualifying deposit is £600. Local representation is understood to be practically essential when tendering for Italian Government contracts.

The Italian Superior Council of Public Works has approved a project relative to the installation of two new electric elevators on the Caracciolo and Assereto bridges in Genoa harbour, the estimated cost, as stated by the *Board of Trade Journal*, being £120,000.

London.—ST. PANCRAS.—July 10th. Arc lamp carbons for the B.C. See "Official Notices" April 30th.

L.C.C.—June 15th. 200 double-deck roof-covered car bodies, 200 car sets of maximum-traction swing bolster trucks, and 200 complete electrical equipments for operation upon both conduit and overhead trolley systems. See "Official Notices" May 14th.

BATTERSEA.—The B.C. has been recommended to provide electric bells in the slipper baths at Latchmere Road and Nine Elms, at a cost of £52 and £34, to enable bathers to communicate with attendants in case of need.

Manchester.—June 16th. Electric light installation for the Guardians' offices in New Bridge Street. Specification (deposit one guinea) from Mr. J. Macdonald, Clerk.

Rotherham.—June 11th. Electric light installation at the Grammar School. See "Official Notices" June 4th.

Salford.—June 14th. Battery, booster and switchgear, for the Electricity Committee. See "Official Notices" June 4th.

South Shields.—June 14th. Stores for the Corporation Tramways Department. See "Official Notices" May 28th.

Stevenage.—The U.D.C. is prepared to receive applications from companies or individuals willing to carry out its provisional order. See "Official Notices" to-day.

Spain.—In connection with the draft Bill which has been drawn up embodying important reforms in the Postal and Telegraph Service, the *Espana Economica y Financiera* (*Madrid*), of April 24th, reports that, among other things, 2,116,000 pesetas (about £75,570) are to be spent on submarine cables, 106,626 pesetas (about £3,810), on telephone apparatus, and 1,263,096 pesetas (about £45,110), on the establishment of 1,235 telephone stations.—*Board of Trade Journal.*

Tunbridge Wells.—June 12th. High and low-tension cables for the Corporation. See "Official Notices" May 28th.

Whitehaven.—July 20th. Lighting the Harbour Quays for five years, by electricity, gas, or other means, for the Harbour Commissioners. See "Official Notices" to-day.

CLOSED.

Barrow.—The Electricity Committee has accepted an offer of the Tudor Accumulator Co., Ltd., to replate the lighting battery and maintain it at its full capacity for a period of 10 years, for 11 annual payments of £138 12s., the first payment being made on completion of the work, and the 11th on completion of the contract, the company to allow £107 for the old materials removed from the battery.

Cape Town.—The agreement between the T.C. and the Municipality of Green Point and Sea Point for the electric lighting of the streets, with the exclusive right to supply electrical energy to private consumers, has now been signed. The tender of Henley's (S.A.) Telegraph Works has been accepted for the cables required for £2,260, delivery within 12 weeks, and that of Glover & Co. for aerial wires for £1,534, delivery within eight weeks.

France.—The French Post and Telegraph authorities in Paris, have placed a contract with Messrs. Geoffroy & Delore, of Clichy, Paris, for the supply of 60,000 metres of telephone cable.

India.—CALCUTTA.—At their meeting on the 3rd ult., the Port Commissioners considered the tenders received for the supply and delivery of cables, lamps, standards, &c., for the improved lighting of the jetties and the Howrah Bridge, and accepted the following:—

Octavius Steel Co.'s, for submarine cables, hard-drawn copper wires, switchboards, distribution switchboards, automatic contact gear, and enclosed arc lamps, at Rs. 23,602.

Balmer, Lawrie & Co.'s, for wires and arc lamps, at Rs. 15,107-13.

Callender's Cable and Construction Co.'s, for porcelain cleats, feeder pillars and steel posts, at Rs. 6,885-12. Under a penalty in each case at the rate of ½ per cent. on the total value of the order for each day's delay in delivery after the expiration of the contract period.

London.—HACKNEY.—The B.C. has had before it this week recommendations of the E.L. Committee regarding the tenders received for materials for the extension of the distributing system:—*Underground Cables*—There were ten tenderers as follows: *Foreign*—The Union Cable Co., Ltd.; Aubert Grenier & Co.; Standard Underground Cable Co. *British*—British Insulated and Helsby Cables, Ltd.; Western Electric Co., Ltd.; W. T. Glover and Co., Ltd.; Johnson & Phillips, Ltd.; Callender's Cable and Construction Co., Ltd.; Siemens Bros. & Co., Ltd.; W. T. Henley's Telegraph Works, Ltd. The three lowest tenders for an average year were as follows:—Union Cable Co., £3,289; Aubert Grenier & Co., £3,392; British Insulated and Helsby Cables, Ltd., £3,538. The British Insulated and Helsby Cables, Ltd., inserted certain conditions as to the carriage and hire of cable drums, which they have agreed to withdraw. The prices tendered by this company are identical with those in the current contract. Messrs. Aubert Grenier & Co.'s prices show a saving of, say, 4 per cent., and the Union Cable Co.'s prices of, say, 7 per cent. on current prices.

The Committee discusses the three firms in its report, and recommends the acceptance of the tender of the B.I. and H. Cables, Ltd. The following remarks will be read with interest:—

The specification is so definite that there is no reason why it should not be enforced without difficulty, even if the work be executed by a foreign firm, but it would not pay to send to the foreign maker's works to make tests on the cables on completion, at any rate upon the small quantities which usually would be coming through at one time. Works' test certificates would be sent on with the cables, and we have provided for carrying out a complete series of tests at our works after delivery before the cable is deemed accepted, which minimises the objection to the acceptance of a foreign tender. Either the Union Cable Co., Ltd., or Aubert Grenier would be willing, if their tender be accepted, to provide at our works, at their cost, all the apparatus necessary for them to carry out the full programme of specified tests in the presence of the engineer.

The extra time required for manufacture and delivery may be raised as another objection to the acceptance of a foreign tender. The British Insulated and Helsby Cables, Ltd., ask for two or three weeks; Aubert Grenier for three weeks; and the Union Cable Co. for three to four weeks for the manufacture and delivery of not exceeding a quarter-of-a-mile of any size of cable. Therefore, there does not seem to be any real objection to the acceptance of one of the foreign tenders on this ground since, in any case, we shall stock for at least a month ahead.

The only grounds upon which there may seem to be reasons for not accepting one of the foreign tenders are those of patriotism and the difficulty of seeing that the labour clauses are acted upon.

Ten firms quoted for the joint boxes, frames and covers, and the contracts are to be divided up between the B.I. and H. Cables,

Ltd., W. Lucy & Co., Ltd., and Sykes & Sugden. Competitive tenders are to be invited for a new design of three-core service from B.I. and H. Cables and Sykes & Sugden. The following tenders are also recommended for acceptance:—

Box Compound.—British Electrical Trade Supply and Bitumen Co.
Resin Oil.—B.I. & H. Cables, Ltd.
Tapes.—W. T. Henley's Telegraph Works Co.
Pitch Compound.—J. Smart & Son.
Earthenware Troughs and Bridge Pieces.—Doulton & Co.
Tiles.—J. Joberns & Co.
Open-type White Arc Lamp Carbons.—Sloan Electrical Co., Ltd.
Yellow Flame Arc ditto.—General Electric Co., Ltd.

Lowestoft.—The Corporation has accepted the tender of Messrs. Crompton & Co., Ltd., for the supply of an electric capstan and 5-H.P. motor, at a cost of £105. The tender of Messrs. Morris & Bastert, for lifting gear, at £39 17s., has also been accepted.

Morecambe.—The Bradford Electrical Co. are carrying out the contract for the electrical fittings to the Morecambe Tower and Casino, which will be brilliantly illuminated.

Rotherham.—The T.C. has accepted the tender of Halley's Engineering Co., at £685, for the supply of a motor tower wagon for the tramways undertaking.

Salford.—The following tenders have been accepted for annual supplies for the electricity undertaking:—

Liverpool Electric Cable Co.—Rubber-covered cable.
Electric and Ordnance Accessories Co., Ltd.—Switches and fuses.
J. H. Tucker & Co.—Cut-outs.
H. R. Mansfield.—Stoneware conduits.
Albion Clay Co.—Stoneware conduits and pipes, cable protectors and cable bearers.
Key Engineering Co.—Fibre pipes.
Howard Asphalte Troughing Co.—Asphalte bridges.
Aubert Grenier and Co. (Switzerland); W. T. Glover & Co., Ltd.—Cables.
Veritys, Ltd.—Motor-starters.
British Thomson-Houston Co.—Carbon-filament glow lamps.
Ross & Co.; Callender's Cable and Construction Co., Ltd.; L. Andrew and Co.; Baxendale & Co.; W. T. Henley's Telegraph Works Co., Ltd.—Cable accessories.

Saltaire.—The work of installing electric light and fittings in the extension of the Sir Titus Salt's Hospital at Saltaire, Yorkshire, is being carried out by Mr. R. Lindley, jun., of Kirkgate, Shipley.

Sheffield.—The Tramways Committee has accepted the tender of Messrs. W. H. Allen, Son & Co., Ltd., for the dismantling of No. 1 condenser, and for the supply and erection at the Kelham Island power station of a surface condensing plant, at £1,933. The following tenders for the annual supply of coal have been accepted:—

M. C. Burnby & Son.—100 tons of slack per week at 7s. 3d. per ton, and 125 to 175 tons of nuts per week at 9s. 5d. per ton.
Tinsley Park Colliery Co.—300 tons of nuts per week at 9s. per ton.

The E.L. Committee has, subject to the usual sanction, accepted the tender of Edgar Allen & Co. for the necessary cable for the main feeder from Rockingham Lane sub-station to Heeley sub-station. An order has been placed with W. T. Glover & Co., Ltd., for 50 tons of electrolytic copper wire, and 50 tons of lead at the present current prices.

Stockport.—The T.C. has accepted the following tenders:—

Frank Pearn & Co., Ltd.—Boiler feed pump, £138.
Mr. Herbert Parkes.—Ironwork for overhead bunkers, £25.
Brecknell, Munro & Rogers.—Trolley standards, £5 each, and ball races, £1 7s. 6d. per set.
Edgar Allen & Co., Ltd.—Loop points.
Horner & Co., taking out two cross-overs and laying new one, £137.
J. & W. S. Briscoe.—Re-laying loop at Gatley terminus, £52.
John Spencer, Ltd.—Light tramway poles, £3 18s. each; medium ditto, £5 0s. 3d.; heavy ditto, £6 11s. 3d.

Swansea.—The E.L. Committee has accepted tenders for a 12 months' supply of motors and starting switches as follows:—

Electric Ordnance and Accessories Co., Ltd.—Electric motors as required, in accordance with the schedule of prices submitted, totalling £240, for one motor of each of the following sizes; ½, 1, 2, 3, 5, 7, 10, 15, 20, and 25 B.H.P.
Brook, Hirst & Co.—For starting switches for a similar period, as required, in accordance with schedule of prices, totalling £70, for one of each of the same sizes.

Wallasey.—At the meeting of the U.D.C. on Thursday last week, the Electricity Committee recommended that the tender of the Premier Accumulator Co., Ltd., Northampton (£2,217), for the supply and erection of a battery and booster plant, with accessories, be accepted, subject to a contract being entered into for the proper carrying out of the work. There was a disposition on the part of many members to criticise the Committee's recommendation, and eventually, on the ground that it was not the lowest tender, an amendment was moved and carried by 16 to 8, referring the matter back to the Committee.

York.—At a meeting of the T.C. on the 7th inst. the recommendation of the Tramways Committee, already mentioned in these pages, that the tender of Messrs. Dick, Kerr & Co., Ltd., to construct and equip the tramways system, at a cost of £78,000, be accepted, was agreed to. Alderman S. W. Meyer stated that the time specified in the contracts was 12 months, but arrangements had been made by which that time could be reduced to six months.

FORTHCOMING EVENTS.

Royal Institution.—Friday, June 11th. At 9 p.m. Discourse on "Problems of Helium and Radium," by Prof. Sir J. Dewar.

Physical Society.—Friday, June 11th. At 8 p.m. At the Imperial College of Science. Papers by Dr. A. Russell and Mr. A. Wright on "The Arthur Wright Electrical Device for Evaluating Formulæ and Solving Equations"; by Mr. C. C. Paterson on "The Proposed International Unit of Candle Power"; by Dr. J. W. Nicholson on "Inductance and Resistance in Telephone and other Circuits"; and by Mr. G. W. Walker, "Note on Terrestrial Magnetism."

Faraday Society.—Tuesday, June 15th. At 8 p.m. At the Library of the I.E.E. Address on "The National and International Conservation of Water for Power," by Mr. E. R. Taylor. Papers on "A Contribution to the Study of Electric Furnaces as Applied to the Manufacture of Iron and Steel," by Mr. C. A. Keller; and "Automatically Circulating Furnaces of the Gin Type, for the Electric Production of Steel," by Mr. G. Gin.

Incorporated Municipal Electrical Association.—Monday, June 21st to 25th. Annual Convention at Manchester. For list of papers and arrangements see ELECTRICAL REVIEW for April 23rd and May 21st.

NOTES.

Personal—A Correction.—In our "Personal Column" of May 28th we inserted a notice regarding Mr. Aubrey V. Clayton, M.I.E.E., in which we stated that Mr. Clayton had been connected with the design and erection of Pinkston power station, Glasgow. This was an error on our part, and we are requested by Mr. Clayton to rectify it. The only power stations with which he was connected here were: Dublin Tramways, Middlesbrough, and the Central London Railway. During the nearly nine years that Mr. Clayton was resident in Sweden a great amount of work was carried out under his direction, as may be judged from the fact that plant representing about 250,000 H.P. was built to his designs, and is in successful operation. A great part of the machinery was made at Mr. Clayton's own works—the Clayton-Unger Electrical Works, Sweden. In his consulting practice Mr. Clayton will specialise in hydro-electrical developments. He is allied with the Vattenbyggnadsbyrå (the Hydraulic Association of Scandinavia), having as colleagues Prof. Richert and Lieuts. Lübeck and Westerberg, Scandinavia's greatest experts on hydraulics. Among other schemes they are at present carrying out are a hydro-electric development of 75,000 H.P. at Vamafos, in Norway, for the manufacture of saltpetre from the air by the Birkeland-Eyde process, and a 73,000-H.P. hydro-electric development at Tya, Norway, also for saltpetre manufacture. This latter scheme has a height of head of 3,290 ft., which is one of the greatest heads of water for power purposes in the world.

Duties on Land Values.—An interesting statement has been issued to Members of Parliament by the Trafford Park Estates, Ltd., showing how seriously and unfairly land companies such as their own will be affected if the provisions of the first part of the Finance Bill as now drafted are passed.

An Electrical Fog Signal.—We recently mentioned (page 887) the installation of a fog signal for Guernsey, which will be worked electrically from the shore. We are informed by Messrs. Reavell & Co., Ltd., who are the contractors for the generating plant and air compressors, that the plant consists of two Crossley oil engines situated in a building on shore, each of these engines driving on one side a Mavor & Coulson alternator, while one of the engines is, on the other side, direct coupled to a Reavell quadruplex compressor, provision being made on the other engine for a similar compressor at some future date. In the lighthouse on the Platte Fougère rock, 1¼ miles distant from the shore, are installed two Reavell quadruplex compressors, direct coupled to Mavor & Coulson motors, the current being conveyed by a submarine cable from the generators on shore. The switchgear is arranged so that either compressor can be set in motion from the shore station by means of a special switch. The compressors on the rock are fitted with a special oiling arrangement to enable them to run for several days without attention, as in rough weather it is impossible for an attendant to get out to the rock. This interesting installation is probably unique, and presents an excellent example of the flexibility of electrical methods. No other means known to us could have accomplished the desired end.

Copper.—The price of this metal shows signs of a distinct revival, but it does not seem probable that a serious rise will ensue just yet. Visible supplies (as shown by Messrs. Merton's circular for May 29th) are still exceptionally high, 56,854 tons, and the real trade revival can hardly be said to have commenced. In the detail figures we find North America much increased in supplies, Spain moderate, Chile lower, and Australia average. In case of a strong demand, it is obvious that North America at once assumes the control, and even in buying for genuine consumption, as at present, the same influence is soon felt.

More Protests Regarding the One-Sided Inquiry.—In the *Daily Express* other trades are being subjected to the same kind of treatment as the electrical trade received, and protests are tendered by those who are actively watching over the interests of these industries. A protest from the hardware trades is now followed by one from *Footwear* regarding the shoe, leather and allied industries. In these there are said to be 2,100 firms engaged—but the inquiry agent is satisfied to base his calculations upon the figures given in 39 favourable replies.

Taxation of Lamps in Germany.—A surprise has been sprung upon the German electrical industry by the action of the present (Conservatives and allies) majority of the Finance Commission of the Imperial Parliament, who are believed to have acted either at the instance or with the support of the Secretary of the Treasury. A few months ago, as will be remembered, the majority then controlling the Finance Commission rejected the Government proposals for the taxation of the consumption of electricity and of various electrical manufactures. Now, however, the present Finance Commission has adopted a completely worked-out scheme for the imposition of a tax on electric glow lamps, mantles for gas, spirit and similar incandescent lamps, carbons for arc lamps, mercury vapour lamps and similar electric lamps, in so far as they are intended for use in Germany. The taxes are as follows:—

1. Electric glow lamps and filaments—
   - Lamps up to 15 watts ... ... ⅝d. per lamp.
   - „ of over 15 and up to 25 watts ... 1¼d. „
   - „ „ 25 and up to 60 watts ... 2½d. „
   - „ „ 60 and up to 100 watts 3¾d. „
   - „ „ 100 watts ... ... 6d. „
2. Carbons for arc lamps ... ... 1s. per kg.
3. Mercury vapour and similar lamps—
   - Lamps up to 100 watts ... ... 1s. per lamp.
   - Lamps of over 100 watts ... ... 1s. extra for each 100 watts or portion thereof.

The projected tax on mantles for incandescent gas and similar lamps is 1½d. per lamp. The tax is to be paid by manufacturers by the employment of revenue labels on the packets before the removal of the packed goods from the place of production. In the case of imported merchandise, the tax is to be paid by the importer either on clearing the Customs House, or where this does not take place, within a period of three days after reception. The amount of the tax is to be refunded in regard to articles returned by recipients to the makers as being unserviceable. The scheme also deals with the question of compulsory packing, whilst the method of packing and the size of the admissible packets are left for the decision of the Federal Council. It is further provided that on the day of the measure coming into operation, the manufacturers, salesmen and merchants have to make an inventory of their stocks of articles liable to taxation, and to notify the Inland Revenue Board within a week. The notified stocks can be sold free of tax for a month in the case of makers and two months in that of dealers, any stocks remaining after the expiration of these periods to be subject to the tax. The Bill also makes provision for the imposition of fines for contraventions of its conditions.

The Testing of Permanent Way.—An inspection was recently made of the experimental electric railway which was constructed some time ago in the wood near Oranienburg for the Prussian State Railway Administration, or the Central Railway Board at Berlin. The railway, which forms a circle, is used for the testing of various kinds of permanent way. The trials are conducted with an electric locomotive built by the A.E.G., which is hired by the railway authorities, and which hauls round the track a goods train of a total weight of 375 tons at a speed of about 31 miles an hour. A record is made of the daily performances, consumption of energy and the cost of maintenance. The permanent way was wholly changed some time ago.

National Electrical Manufacturers' Association (Inc.).—A Committee meeting of this Association will be held at the offices on Tuesday, June 15th, at 2.30 p.m.

Electricity Beats Gas again.—In the Birkenhead Municipal Bowling League, on June 8th, the Electricity Works scored a notable victory over the Gas Department by 11 points. The latter team received the best support, the chief and two assistant gas engineers and some members of the Gas Committee being present, but even this influential support was insufficient to enable the gas men to put out the rival illuminant.

Hampstead Electricity Works Swimming Club.—On Friday last the members of this Swimming Club swam off an interdepartmental team race—Engine Room *v.* Mains. The Mains Department proved victors after a finely-contested race. The secretary of the above club (Mr. E. A. Pells) would be pleased to fix up team races with any other lighting stations or swimming clubs connected with the electrical industry.

Canadian Electrical Developments.—Our Ottawa correspondent writes: "The Ontario Hydro-Electric Commission is enlarging its staff with the increase of work under its direct supervision. About 40 engineers and their assistants will be appointed, and the work of the Commission divided into four branches, namely, engineering, construction, operating and accounting. There will also be shop inspectors, foremen and assistants. The power will be distributed from Dundas, Ont."

Steel Rail Trade.—The *Standard* says it is reported that the Shelton Iron and Steel Co., of Stoke, North Staffordshire, have resolved to enter the steel rail trade. "Steel rail-rolling machinery is to be immediately installed, and all steps taken for going into the business with vigour. The step is an important one, and there are rumours of other firms following their example. Steel rails are now selling at £5 5s. to £5 7s. 6d. for heavy sections, and £5 15s. to £5 17s. 6d. for light sections. The new competition is likely to assist lower values."

Institution and Lecture Notes.—"G.B." System.—On Monday evening last Prof. J. T. Morris, M.I.E.E., of the East London College, lectured at that institution on "The Technical Aspects of the G.B. System of Electric Tramways," Mr. W. H. Patchell, M.Inst.C.E., being in the chair. In opening the lecture, Prof. Morris described the elements of the system, and exhibited lantern slides lent by Mr. Bedell. He also illustrated his remarks with the aid of working models. Great improvements, he said, had taken place since he last lectured on the subject, and it was necessary to realise the fact that this system was more or less in its infancy. No engineer would say that it would work without any fault at the beginning; it was true that extensive experiments ought to be carried out, not only in order to prevent accidents, but also to ensure efficient working. This system would have to be developed at some time or other, and although it undoubtedly had defects, it contained the elements of success; in the lecturer's opinion, it was a great pity that sufficient perseverance had not been shown in order to bring it to a successful issue in the case of Mile End Road. The principal difficulties were occasioned by live studs, by leaky gas mains, and by cross-overs. Naturally with electric and gas mains in the same streets for miles, it was certain that the pipes conveying the cables would sooner or later contain some of the gas, and, with the air already there, it was clear that all that was necessary was a spark, in the shape of a small arc, in order to create an explosion. He was convinced that in the experiments which had been carried out in the Mile-End Road explosions had occurred, and that the covers of the studs had been blown upwards. Obviously the right thing to do was to blow through the pipes. It was insane to work the system without having a supply of air passing either steadily or at intervals through the pipes. These precautions had been taken at Lincoln, and also here, after which there had been no further trouble in that connection, while the cost of electricity to work the blower was very small. The live studs might be caused by a broken spring, by a link getting free, or by a spring dropping away. A stud might also remain alive through an arc burning between the cable and the block after it rose from the cable, and then there might be 300 or 400 volts between the top of the stud and the rail. It might be possible to shunt the arc by means of a resistance placed in circuit between the block and the cable, while another method was by placing a condenser in circuit between these points. This matter had been the subject of investigation in the lecturer's department of the college, and although he could not offer a complete solution of the problem, the experiments showed the following results with a current of 0·75 ampere, capacity 1 microfarad:—

Condenser across arc.		Condenser across resistance.	
Resistance.	Extinction of arc.	Resistance.	Extinction of arc.
Zero	Certain	Zero	Certain
90 to 110 ohms	Doubtful	50 ohms	Doubtful
Over 120	Fails	Over 60	Fails.

The investigations in connection with these experiments were not yet complete. It was unfortunate that the G.B. system should have been installed in a thoroughfare such as Mile-End Road, one of the arteries of London, where there was such an enormous amount of traffic. Before an installation of any system was carried out it ought to be thoroughly tried, but once it was decided on it should be carried through to the finish. Where the company had a free hand in the construction work, he was convinced that it would be a success.

Petrol-Electric Automobiles.—The Auto-Mixte petrol-electric system for motor cars formed the subject of an interesting paper read to the Coventry branch of the Incorporated Institution of Automobile Engineers by Mr. F. M. Green, A.M.Inst.C.E. (Daimler Motor Co.). Mr. Green explained that the system consisted of a petrol engine, mounted on the crankshaft of which was the armature of the machine, which worked either as a dynamo or a motor. A small accumulator was fitted, which was kept more or less constantly charged by the surplus power of the engine, and which was also very useful for braking and other purposes. Directly the engine slowed down through any resistance, such as the mounting of a hill, current from the accumulator flowed into the machine, which then acted as a motor. It was not necessary to have any elaborate arrangement of switches on the main current; the speed regulation was obtained simply by altering the strength of the magnetic field. In practice they got a variation of speed of about five to one. To prevent overcharging there was a simple device on the carburettor, which consisted of a solenoid connected up to a butterfly throttle; when the charging current exceeded a certain limit the solenoid acted and shut off the throttle, thus acting as a governor. By this means it was possible to regulate the speed automatically. They used a dry plate-clutch with a single plate operated magnetically. The clutch plate was also made to serve the purpose of a magnetic brake. The braking was extremely gentle, and could not possibly skid the wheels, because if the wheels skidded the brake effect also stopped. It was found that they could pull up as quickly as by any mechanical brake, and they finished up by using a mechanical brake to slow from four miles an hour to standstill. At starting they could get more than double the usual torque by using the accumulator. They found that with a very heavy 'bus they could get more than 2 ft. per second per second acceleration, and they hoped to get even better results eventually. There was no loss of time in changing speed, as it did not depend on the skill of the driver at all. With the petrol motor and accumulator combined, it could surmount a gradient of 1 in 12 at the legal speed limit. If the engine stopped through misfiring, the electromotor pulled it round. The engine could not race; it had always work to do, and it was self-starting. Current was also available to

light the vehicle. In case one ran out of petrol it was possible to crawl as much as three miles on the battery alone.

A joint summer meeting of the North-East Coast Institution of Engineers and Shipbuilders with the Institution of Engineers and Shipbuilders in Scotland is to be held in Glasgow on August 4th, 5th and 6th next. It is estimated that the cost per head from Newcastle will not exceed five guineas. An advance programme has been issued, and further particulars can be had from Mr. John Duckitt, the secretary.

Institution of Gas Engineers.—The annual meeting of this Institution will be held in London at the house of the Institution of Mechanical Engineers, from June 15th to 17th inclusive, under the presidency of Mr. Thomas Glover, the engineer and manager of the Norwich works of the British Gas Light Co.

McGill University.—A Montreal paper reports that a new steam, heat and electric power installation is to be furnished to all buildings at this University at a cost of $150,000. Prof. Herdt is to supervise the electrical portion of the work.

Motor-Driven Drawbridge.—A new drawbridge has been constructed to cross a canal in a busy thoroughfare in Edinburgh. It is for heavy traffic, and has a platform 32 ft. wide, including two footpaths each 4 ft. wide. For the previous bridge a hand winch was used, but in this case a 12-H.P. 460-volt D.C. motor does the raising and lowering. Messrs. Armstrong, Whitworth & Co., Engineers, Newcastle-on-Tyne, were the contractors.

The Canal Burst in Belgium.—The bursting of the Willebroeck Canal last week came very near to bringing about a stoppage of the railways, as the Société Bruxelloise d'Electricité Privilegiees, which is dependent on the canal for the water for its boilers, has the contract for the supply of the current for operating the electrical signalling arrangements at the Nord Station, in Brussels. Fortunately the company some time ago made an arrangement with the Société des Tramways Bruxelloise whereby the power stations of the two undertakings were connected together. The first-named concern was, consequently, able to take advantage of the arrangement and maintain an uninterrupted supply of current.

The Electric Football League.—We are informed that the annual general meeting, which was held on May 19th, was well attended. The balance-sheet (showing a balance in hand of £2), on being adopted, was followed by applications being read from new clubs, the City of London Electric F.C. and Poplar Borough Council being amongst the number. The matter was adjourned until the special general meeting, to be held shortly.

Tramcar Accident.—In the King's Bench Division, Mr. Justice Coleridge was occupied during the greater part of Tuesday and Wednesday in hearing a case in which a Mr. Franklin and his wife, of Wandsworth, sought to recover from the London County Council damages for injury caused by a collision between two of the Council's electric cars, which occurred in the neighbourhood of Vauxhall, on August 9th last. The wife was travelling in the car, and as the result of the shock sustained, it was alleged, permanent internal injury, in respect of which she claimed. The husband claimed for expenditure made by him on medical attendance upon his wife. The facts were not disputed, and the jury, in the result, awarded £150 damages to the wife.

Fatality.—Mr. Edwin Dickens, son of Mr. A. C. Dickens, electrician, Bridlington and Northampton, met with his death on June 3rd. He was inspecting the E.L. fittings on the dome of the Bridlington Grand Pavilion when he fell through the skylight into the hall below, and was instantly killed.

Parliamentary. — L.C.C. Tramways.—On Wednesday the Select Committee of the House of Commons, presided over by Sir George Doughty, met for the first time after the Whitsuntide recess. Mr. Lloyd, K.C., addressed the Committee on behalf of the Bermondsey Borough Council, and asked that certain street widenings should be carried out where it was proposed to run the trams through the Borough. The Committee asked that the local authority should have a voice in the selection of the materials used for the relaying of the road, as the ultimate upkeep of the roadway fell upon the Borough Council.—The chairman remarked that the Committee could not make Mr. Fitzmaurice's (the engineer to the Council) judgment subservient to the opinion of a district surveyor.

Evidence was then given on behalf of the Borough Council's opposition. The principal point of contention arose over the widening of the corner at Dockhead and Parker's Row where the roadway is already very narrow, and where there is a single track running. The Borough Council's witnesses asked that a proper widening should be made so as to make the corner safe. They suggested that the County Council should acquire a strip of land in front of a Roman Catholic school, but the County Council opposed this, as they might under the Land Clauses Act have to take the whole of the school.

The Committee having deliberated in private, the Chairman said that with regard to the proposal for extending the line at Tooley Street, the Committee were of opinion that the terminus should remain where it was. As to Dockhead, they were of opinion that the thoroughfare should be widened up to the point shown on the Bermondsey Borough Council's plan, and they would like to see that carried out. If that could not be done, the Committee stipulated that only a single track should be laid down, and that some authority should be put on duty to regulate the traffic. At Parker's Row they thought the Council had met the requirements of the case. With respect to the two forecourts at 171 and 173, Jamaica Road, the Committee thought that the Council should acquire the forecourts up to the shop-front but not the shop-front itself.

The case for the reconstruction of the Highgate Hill portion of the Council's system of tramways was then proceeded with. Mr. Erskine Pollock, K.C., explained that at present the line was worked on a narrow gauge by a cable, and that had not been in every respect a satisfactory way of working the tramway. Part of the line was in Middlesex County and partly in the County of London. The Council had come to an agreement with the Middlesex County Council. It was proposed to reconstruct 5 furlongs 7 chains of the line on a double track, except 4·5 chains which was in the High Street. The only opposition to the scheme was that of Mr. W. C. Bloxam, an owner of property on the Hill. The total cost of the widening and reconstruction will be £57,850.

Mr. A. L. C. Fell, tramway manager, explained in detail the Council's proposals.

Central London Railway.—In the House of Commons on Friday the Central London Railway Bill was read a third time.

Electricity Works Table.—This Table will be closed for Press on Saturday, June 19th; final corrections should be sent in at once.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. A. Lockwood, station superintendent, North Wales Power and Traction Co., Cwm Dyli power house, was presented by the staff on June 1st with a pair of silver military hair brushes, suitably inscribed, on the occasion of his marriage with Miss Florence G. Blcomfield, of Pen-y-Gwryd.

The Beckenham Council has appointed the chairman of the Electricity Committee, Mr. A. H. Dykes, to be its delegate to the annual Convention of the Municipal Electrical Association. It has also authorised the resident engineer of the electricity works, Mr. Tapper, to attend, his expenses to be covered by the necessary addition to his salary.

The Stoke T.C. has, by eight votes to seven, agreed to the recommendation of the Electricity and Destructor Committee that the salary of the electrical engineer, Mr. Tiddeman, be increased by £50 per annum to £400.

On Wednesday last week, Mr. J. W. Beauchamp, deputy manager of the Sheffield Corporation Electric Supply Department, was the recipient of several articles of Sheffield plate subscribed for by the staff and employés, as a token of esteem and goodwill, the occasion being Mr. Beauchamp's departure from Sheffield to Tunbridge Wells, to take up the position of resident electrical engineer. In making the presentation, Mr. S. E. Fedden, the general manager, referred to the good work Mr. Beauchamp had done during his 8½ years' service with the department.

Mr. J. Bembrose having been appointed chief assistant at the Tunbridge Wells electricity works, Worcester T.C. has re-arranged the electricity staff as follows, effecting a saving of £39 per annum:—Mr. R. Smith, mains superintendent, to be chief assistant and mains superintendent at £140 per annum, an increase of £10; Mr. E. Page, mechanical assistant, to be station superintendent, at £120, an increase of £16; Mr. H. H. Smith, second engineer-in-charge, to be first engineer, at £114, an increase of £13; Mr. P. Fox, assistant, to be third engineer-in-charge, at £78, an increase of £13; Mr. J. Addyman, improver, to be junior assistant, at £39.

At the West Ham electricity offices recently, the staff and employés of the department made a presentation to Mr. A. H. Seabrook, the retiring electrical engineer, who is shortly leaving for Marylebone. The presentation took the form of a silver tea tray.

Mr. L. C. B. Trimnell, resident engineer of the Richmond (Surrey) Electric Light and Power Co., Ltd., was recently presented with a barometer and inkstand by the staff and employés of the company, on the occasion of his approaching marriage.

General.—Mr. O. H. Bishop, for many years sales manager to the Edison & Swan United Electric Light Co., Ltd., has resigned his position with the company in order to take up other work, particulars of which we hope to announce shortly.

Mr. H. C. Jenkins, the South Yorkshire representative of the British Westinghouse Co., has accepted the position of managing director of the Mining Engineering Co., Ltd., of Foster's Buildings, Sheffield, and takes up his duties at once.

Mr. J. H. C. Brooking has been appointed general manager of the St. Helens Cable and Rubber Co., Ltd., of Warrington.

Obituary.—Mr. Thomas Smith.—We regret to record the death of Mr. Thomas Smith, head of the firm of Messrs. Thomas Smith & Sons, steam and electric crane manufacturers, of Old Foundry, Rodley, at the age of 72 years. His three sons Messrs. Frederick, Walter and George Smith, will carry on the business.

In last week's issue of *Nature* we note an announcement of the death of M. Eugène Grenet, the inventor of a potassium bichromate cell.

The death has occurred recently of Mr. Frederick Bridges, one of the directors of the Ascot District Gas and Electricity Co.

NEW COMPANIES REGISTERED.

Bristol Electro-Chemical Co., Ltd. (103,193).—This company was registered on May 25th, with a capital of £500 in £1 shares, to carry on the business of manufacturers of and dealers in carbide of calcium and other chemicals, and apparatus, machines or plant for the utilisation thereof, &c. The subscribers (with one share each) are:—G. L. Young, 9, Winchester Road, Highgate, N., merchant; S. C. K. George, The Brackens, Ascot, Berks., gentleman; Mabel B. Bevan, 85, Ingleby Road, Ilford, clerk; R. J. Starke, 48, Grant Road, Clapham Junction, S.W., clerk; O. A. Blexam, Vine Leigh, Bourne End, Bucks., gentleman; E. M. May, 27, Hornsey Lane Gardens, Highgate, N.; Phyllis E. Smith, Esperanto House, Cheltenham Road, Southend-on-Sea, clerk. Private company. Table "A" mainly applies. Registered office, Thorp & Saunders, Salisbury House, London Wall, E.C.

CITY NOTES.

Aron Electricity Meter, Ltd.

The twelfth ordinary general meeting of this company was held on Tuesday at Winchester House, E.C., Mr. H. Hirst presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, June 4th, page 937), said that for the purpose of comparing the figures with those of the previous year, they had the disadvantage of having only a six months' balance-sheet preceding the present, but the net results were quite in proportion to the previous six months, bearing in mind that the latter period dealt with the winter half-year, which, in electrical concerns, was the more important half of the whole. Roughly speaking, all the figures referring to trading on the debit side of the profit and loss account were double those of the previous financial period, as were also the gross profits, which this year represented £34,000, as against £17,000 for the preceding half-year. As regards the balance-sheet, the figures on the debit side required no comment, the outstanding features being that the debenture issue showed £5,000 less, and the reserve £5,000 more, and that after payment of the 7 per cent. dividend recommended by the directors, there would be now only 6 per cent. in arrear for preference dividends. With a continuance of business such as they had enjoyed for the past three or four years, the time was drawing very near when the holders of ordinary shares would commence to take their proper share in the yearly results. The directors were fully alive to their responsibilities towards the ordinary shareholders, but in their decision they must be guided entirely by the state of their liquid assets. The payment of 10 per cent. to the preference shareholders, as had been effected during the past few years, absorbed about £12,500. They had to pay annually £5,000 for the redemption of debentures. Directors' fees and management bonuses absorbed several thousands more, and, as the balance-sheet showed, the continued extensions of the business required constantly more capital. They were at present commencing additional buildings at their factory in Schweidnitz, and they had to build new premises in Paris, where, he was happy to state, their business was showing great progress. They had extended their electric clock business in Germany, which required additional capital, and they had pushed on the taximeter business, which had absorbed nearly £10,000 additional capital. The outlook was very reassuring, and they hoped to reap in the near future the benefit of these extensions, but the figures he had given explained the necessity of keeping plenty of funds in hand for the continued safety of the company. As regards the item of stock, which was about £9,000 more than at March 31st, 1908, the increase was entirely due to the taximeter business. Taximeters were not generally sold outright, they were hired out. This meant an immediate demand on capital for the purpose of stock, whilst the benefits came back over a number of years. They had given their attention to the more modern type of public vehicle—the motor-cab—and there were several hundred of their taximeters fixed to motor-cabs in London and the country, which were performing in a very satisfactory manner. A considerable number of horse cab taximeters were also on the roads in a number of provincial towns. They had also commenced to build up a taximeter business on the Continent. In conjunction with the well-known firm of Nagelmackers et Fils, of Brussels and Liége, a taximeter company was formed in Brussels, in which they held about two-fifths of the shares, for the purpose of hiring out taximeters in Belgium. The latter company had already received orders for several hundred instruments, which had partly been delivered, and which were in service in Brussels. The taximeter company had made a special agreement with the Brussels Taxicab Co., owned by the same interests, by which all their cabs would be fitted with the Aron taximeter. Apart from this large customer, the company in Brussels was getting orders for taximeters for motor-cabs and horse cabs from other customers as well, in Brussels and also in other parts of Belgium. He had referred to the taximeter business as it was quite possible that it would be a large factor in their business in the future, though he would like it to be understood that this department had not yet contributed to the profits in the accounts before them. They had to thank for these their old Aron meter business. They had now a line of instruments in direct and alternating clock and motor-meters, in two-rate meters, in accumulator meters, prepayment meters, and, in fact, in every kind of instrument suitable for any conditions required by electrical industry. Thanks to the skill of Prof. Aron and his staff they could compete favourably with every type, and with any other make, offered in any part of the world.

Sir James Pender, Bart., seconded the motion, and the report was adopted.

United Electric Trams of Monte Video, Ltd.—The directors in their report state that the native company showed gross receipts for the year ended October 31st last of $1,093,870, an increase of $158,396 compared with the previous year, while the operating expenses were $701,009, an increase of $81,349. Net receipts were $392,861, an increase of $77,047. The gross receipts subsequent to October 31st, 1908, showed a continued increase. The conversion of the whole of the company's line from animal to electric traction was completed during the year. Including various extensions, there is now a total of 80 miles of single track in operation. The profit and loss account, after providing for administration expenses and charging £35,107 for debenture interest, shows a credit balance of £49,469, plus £11,963 brought forward, making a total of £61,432. After writing off certain sums, there has been set aside for the debenture stock sinking fund (£2,100), and there has been transferred to a renewals and contingency account £10,000. After the dividend on the preference shares at the rate of 6 per cent. per annum, less income-tax, has been paid, the directors recommend a dividend on 67,200 ordinary shares at 5 per cent. (less income-tax) for the year to March 31st, requiring £15,960 (the balance of 12,800 issued ordinary shares rank for dividend from April 1st, 1909), leaving to be carried forward £11,118.

Dunderland Iron Ore Co., Ltd.—Speaking as chairman of an informal Committee recently appointed to go into the affairs of this company, Sir George Gibb on Tuesday told the holders of 6 per cent. first charge debenture stock (as reported in the *Times*) that the company's real difficulty was not one of capital, but one arising out of the separation of the iron from the ore. The dry magnetic process had failed, and the works had been stopped, creating a very serious situation. Subject to high expert opinion, which the proposed new Committee would secure, it was suggested that adequate trial under commercial conditions should be given to the Grondal process of wet magnetic separation. A Committee was appointed, which will take expert advice.

Western Telegraph Co., Ltd.—The directors have declared the third quarterly interim dividend of 3s. per share, free of income tax, for the year ending June 30th, 1909, being at the rate of 6 per cent. per annum. The transfer books will be closed from June 17th, to 23rd, and the dividend will be payable on June 24th.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the five weeks ended April 30th, 1909, were 740,714, compared with 712,042 units in the corresponding five weeks of 1908.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to—

Victoria Falls and Transvaal Power Co., Ltd.—Further issue of 900,000 6 per cent. cumulative preference shares of £1 each, fully and partly paid, Nos. 808,001 to 1,708,000.

And to appoint a special settling day in—

Brush Electrical Engineering Co., Ltd.—£100,000 5 per cent. prior lien debenture stock.

The Committee have appointed a special settling day as under:—

Wednesday, June 16th.—Bandjarsarie (Java) Rubber Co., Ltd.—Seven shares of £1 each, fully paid, Nos. 1 to 7; and 9,993 shares of £1 each, 15s. paid, Nos. 8 to 10,000.

Brush Electrical Engineering Co., Ltd.—£100,000 5 per cent. prior lien debenture stock.

Hurst, Nelson & Co., Ltd.—20,000 6 per cent. cumulative preference shares of £10 each, fully paid, Nos. 1 to 20,000.

Traction and Power Securities Co., Ltd.—The directors report that the profit and loss account shows a credit balance of £20,948, plus £4,826 brought forward. Of this £20,000 is transferred to the investment reserve account, leaving £5,775 to carry forward. The investment reserve is £85,000.

India-Rubber, Gutta-Percha and Telegraph Works, Co., Ltd.—The directors announce an interim dividend of 2½ per cent. (5s. per share), free of income-tax, on the ordinary shares for the half-year ended March 31st.

R. Waygood & Co., Ltd.—A dividend of 7 per cent. for the six months to March 31st is recommended, making 6 per cent. for the year.

Perth Electric Tramways, Ltd.

Mr. Allen H. P. Stoneham presided on June 3rd at the offices of the London Chamber of Commerce over the tenth annual meeting of the above company.

In moving the adoption of the report (see Electrical Review, May 28th, page 893), the Chairman referred at some length to the growth of Perth and Western Australia. He touched on the great improvement in agriculture, and complimented the Government on advertising the advantages of the country. With regard to the accounts of the company, they showed some diminution in profit, which was largely due to the fact that the people of Perth had invested a great deal of capital in land, and were taken up with agricultural pursuits, and did not spend so much time in the city as they used to. This, however, must react to the benefit of Perth, and it was a matter upon which those who were investors, as apart from those who were speculators, were heartily to be congratulated. Another factor which reduced the profit of the past year was the amount spent on repairs and maintenance, which had been charged to the operating account. This question of repairs and maintenance was very closely bound up with that of depreciation and renewals. It was always difficult to know where maintenance ended and renewals began. They had gone on the principle of maintaining their track and cars and machinery at the highest possible pitch of excellence, but, of course, maintenance must necessarily be heavier as the track grew older, and it had forced them to look closely into the question of depreciation. Mr. Somerset, their engineer, had studied the subject, and had recently made a tour of Great Britain to pick up all the information possible on this head. Opinion, however, seemed to vary considerably, and depended on many things. There was the question of the quality of the material used, and of the mode of construction, but in reference to those two points, he might say they obtained the best materials they could, and had constructed the lines in the most lasting manner. They had recently had a striking example of how well the line was constructed, for when they relaid a small portion they had absolutely to chisel the line out. Thirdly, the question was affected by the amount of traffic, the stoppages, the humidity or dryness of the atmosphere which produced oxidisation, and, lastly, it depended on the amount expended in maintenance. They had maintained their plant and line in a first-class condition, but still they must look forward to the time when extensive renewals would have to be made, and they intended to put away a minimum of £2,500 to the cash reserve. The amount was now £8,500, which was invested in good securities. He hoped they would approve of that course, and he felt sure they would reap the benefit in the prosperous years which were sure to come, and which they must be prepared to take advantage of by keeping everything in a high state of efficiency. As to extensions, their original concession was for 17 miles, and they were now operating 19. They had spent more than £22,000 out of profits in making extensions, as they felt that they had a duty to perform to the City and suburbs as well as the duty of paying dividends to the shareholders. They were, however, being continually pressed to make further extensions, but they felt that they could not make them with justice to their shareholders. The people who were pressing them to make extensions were those who owned land and hoped to enhance the value of their holdings by having tramways, and the board were doing their best to meet the position by forming an auxiliary company to take up those extensions. They felt that if such extensions were wanted, the people needing them ought to subscribe towards the capital, and their company would then be prepared to put money alongside. Sometimes he thought the people of Perth were a little unkind to the company, and looked upon them as a rich corporation, making money and giving little in return. Well, the company had been established 10 years, and during that time had only paid an average of 1½ per cent. on the ordinary shares, and further, the capital was raised at a much lower rate than it would have been possible to raise it in Perth. They had also paid nearly £16,000 in royalties, and upwards of £200,000 in wages, which had been spent in the town, whilst they had transformed the unpaved sandy streets into streets as good as those in London.

Mr. C. Wren seconded the motion.

Replying to several questions raised, the Chairman said that the apparent discrepancy in the amount standing to reserve in last year's balance-sheet and the amount put down this year was due to the fact that stores and materials to the amount of £800 had been utilised. It was not proposed to sell the extension already made to an auxiliary company, but it would simply be a question of new extensions. When they were ready with the subsidiary company, they would give the offer to their own shareholders, but they were not making any offer until they had been very carefully into the merits of each individual proposition.

The report was then adopted, and the retiring directors were re-elected.

Kalgoorlie Electric Tramways, Ltd.

The meeting of this company was held on Thursday, June 3rd, at the offices of the London Chamber of Commerce, under the chairmanship of Mr. A. H. P. Stoneham.

The Chairman, in moving the adoption of the report (see Electrical Review, May 28th, page 892), said he would confine his remarks to the future rather than to the past. The accounts were rather later this year in consequence of the visit of Mr. Somerset, their consulting engineer, who had been in London, and whom they thought it well to consult on various engineering matters, and especially with regard to depreciation. The past year, and especially the first portion of it, was a very anxious one, for the traffic fell off considerably, but he was glad to say there was a material recovery in the latter portion of the year. Kalgoorlie depended almost entirely on the mining industry, and the Kalgoorlie mines had recently given the lie to their detractors, who prophesied that they would give out. Having given various statistics of the output of various gold mines in the district, the chairman said that so long as the town prospered so would the tramway, because it was the chief means of transit between Kalgoorlie and Boulder, and was an absolute necessity to the inhabitants. He ought to pay a tribute to the Kalgoorlie Electric Power Co. for the way in which they had supplied them with current without any failure. A shareholder had written asking if it was not possible to reduce the price of power, and pointing out that, as the tramway company was the first customer of the power company, they ought to have the most-favoured-nation treatment. Two years ago he referred to the negotiations pending for a new contract with the power company. The board did their utmost to get the best terms they could, and he did not think it would be any good going back to the power company and asking for a further reduction at the present time. He thought they had very fair terms from the power company, and under the new contract things were satisfactory. One matter which had caused them a good deal of thought was that of depreciation. Fortunately, they had not to consider the question of the depreciation of heavy machinery, and with regard to the cars and track and equipment, they had maintained it to the best of their ability, but still the time was coming when some part would have to be reserved. Were it not for the question of renewals, they would be able to recommend a dividend on the shares, but under the circumstances, they felt it necessary to retain the surplus profit for the purpose of building up a fund against the time when renewals were necessary. The chairman next dealt with the question to be raised at the Colonial Conference of the construction of the Trans-Continental Railway, as bearing on the development of Kalgoorlie, and proceeding, he said that the profits of the company for the first three months of the current year were above those of the corresponding period, so that they looked forward with confidence to a better year than the last. They had lately been able to make some considerable economies by rearranging the running of the cars, but, when all was said and done, profit must, of course, defend the receipts.

Mr. C. C. Baker seconded the motion.

In reply to points raised by Mr. Still and Mr. Thompson, the Chairman said they had no motor-'buses at Kalgoorlie, and he did not think it likely they would have such opposition. They were tried at Perth and were a dismal failure. The debentures on December 31st, 1907, stood at £91,139, and last December at £85,984. They were obliged to put £4,000 a year by to reduce the debentures, and the future amount by which that debt would be decreased would depend on the price at which they bought the bonds. Last year they bought at £85, which was, of course, a good thing for the shareholders.

The report was adopted, and the chairman was re-elected a director.

Leamington and Warwick Electrical Co., Ltd.—The report for the year ended December 31st, 1908, shows a capital expenditure during the year of £779, of which £579 was in respect of cables, mains and other equipment for the supply of electricity in the Borough of Warwick. In October last an issue was made of £35,000 4½ per cent. debentures, in order to provide funds to discharge the company's liability of £28,233 to the B.E.T. Co., Ltd., and to provide working capital. The net balance for the year is £2,265, plus £139 brought forward. The directors recommend placing to depreciation and reserve account £300, to sinking fund for redemption of debentures £350, a dividend of 5 per cent. on the cumulative preference shares for the year £120, a dividend at the rate of 2 per cent. on the ordinary shares for the year £1,351, and to carry forward £282.

Prospectuses.—*Singapore Para Rubber Estates, Ltd.*—This company has this week been offering for public subscription an issue of 100,000 shares of £1 each. The company is to acquire several estates in the State of Negri Sembilan, one of the Federated Malay States, 1,048 acres of which are planted with 184,000 Para rubber trees of various ages.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—This company has this week been offering for subscription at par £687,500 4½ consolidated first mortgage debenture stock. Holders of the first debentures (£250,000) and second debentures (£189,000), repayable on January 1st, 1912, who apply to convert their holdings to the above consolidated stock, will receive preferential allotment. The proceeds of the issue, apart from these conversions, will be devoted to the completion of the Dunston generating station and system, Carville power station extensions, and other developments of the undertaking.

Oldham, Ashton and Hyde Electric Tramway, Ltd.—The directors announce a final dividend of 3½ per cent., making a total distribution of 6 per cent. for the year, carrying forward £199.

Sao Paulo Tramway, Light and Power Co.—A quarterly dividend of 2½ per cent. on the capital stock is payable on July 1st.

Germany.—The Berlin-Hagen Accumulatoren Fabrik Gesellschaft, of Berlin, is declaring a dividend of 12½ per cent. for the last financial year.

MARKET QUOTATIONS.

Wednesday, June 9th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a " Nitric	"	22/-	..
a " Oxalic	"	28/-	..
a " Sulphuric	"	5/6	..
a Ammoniac, Sal	"	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£33 10	..
a " "	"	£30	..
a Bleaching powder	"	£5 10	..
a Bisulphide of Carbon	"	£18	..
a Borax	"	£16	..
a Copper Sulphate	"	£19 10	10/- dec
a Lead, Nitrate	"	£25 10	..
a " White Sugar	"	£23 10	..
a " Peroxide	"	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	9½d.	..
a Potash, Caustic (75/80 %) ..	per ton	£20	..
a " Chlorate	per lb.	3½d.	..
a " Perchlorate	"	3½d.	..
a Potassium, Cyanide	"	7d.	..
a Shellac	per cwt.	70/-	7/- dec.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	"	£6 10	..
a " Recovered	"	£5 10	..
a " Lump	"	£5	..
a Soda, Caustic (white 70 %) ..	"	£10 15	..
a " Chlorate	per lb.	3½d.	..
a " Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
a " Cyanide (basis 100 %) ..	"	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£70	..
b " Wire, in ton lots ..	"	£112	..
b " Sheet, in ton lots ..	"	£120	..
b "	"	£50 to £135	..
p Babbitt's metal ingots	per lb.	7¼d.	¼d. dec.
c Brass (rolled metal 2" to 12" basis)		8⅝d.	..
c " Tube (brazed)	"	7¼d.	..
c " " (solid drawn) ..	"	6⅞d.	..
c " Wire, basis	"	9½d.	..
c Copper Tubes (brazed)	"	9⅝d.	..
c " " (solid drawn ..	"	£75	£2 inc.
c " Bars (best selected) ..	per ton	£75	£2 inc.
g " Sheet	"	£75	£2 inc.
g " Rod	"	£63 5	..
e " (Electrolytic) Bars ..	"	£79 15	..
e " " Sheets	"	£67 15	..
e " " Rod	"	8 5/16d.	..
e " " H.C. Wire	per lb.	8/8	..
e " " "		8/-	..
f Ebonite Rod	"	1/6	..
f " Sheet	"	5/6 to 6/6	..
n German Silver Wire	"	5, 11¾	5½d. inc.
h Gutta-percha, fine	"	49/-	7½d. inc.
h India-rubber, Para fine	"	£14	..
j Iron Pig (Cleveland warrants) ..	per ton	£13 10 to £13 12 6	dec.
l " Wire, galv. No. 8, P.O. qual.	"	8/-	..
g Lead, English Ingot	per lb.	£8 7 6	..
m Manganin Wire No. 28	per bot.	6d. to 1s.	..
g Mercury	per lb.	2/6 to 4/-	..
d Mica (in original cases) small ..	"	4/6 to 8/6	..
d " " " medium	"	1/- to 1/1	..
d " " " large ..	"	1/1½ to 1/3	..
p Phosphor Bronze, plain castings	"	1/3½ to 1/6	..
p " " rolled bars & rods	"	½1/6	variable.
p " " rolled strip & sheet	"	..	..
o Platinum	per oz.	£55	..
e Silicium Bronze Wire	per lb.	£132 to £133	£1 inc.
r Steel Magnet, in bars	per ton	1/8½	..
g Tin, Block (English)	"	..	..
n " Wire, Nos. 1 to 16	per lb.	£35 to £60	..
p White Anti-friction Metals:—		£25 10	..
p "White Ant" brand	per ton		
k Zinc, Sh't (Vielle Montagne bnd.)	"		

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.

Anglo-Portuguese Telephone Co., Ltd. — The directors' report for 1908 states that the profit and loss account shows a gross revenue of £42,048, of which operating, management and general expenses absorbed £22,517 and royalties to the Portuguese Government £1,323, leaving a gross profit of £18,208. After providing for debenture interest £2,433, sinking fund, £1,167, and income-tax £532, there remains a net profit of £14,075. Including £3,745 brought forward, the total amount available for disposal is £17,820. In November last the directors paid an interim dividend of 3 per cent., free of income-tax, amounting to £3,000. They now recommend a final dividend of 5 per cent., free of income-tax, making a total distribution of 8 per cent. for the year 1908. This will absorb a further £5,000, and of the balance it is recommended that £5,000 be placed to reserve (increasing the same to £20,000), and that £4,820 be carried forward. As in previous years, the profit and loss account was credited only with the proportion of subscriptions for which the company had actually rendered service during the year. The proportion of the year's subscriptions unearned at December 31st, amounting to £15,211, has been treated in the balance-sheet as a liability of the company.

STOCKS AND SHARES.

Tuesday Afternoon.

Stock Exchange energy continues to be chiefly absorbed by speculation in South and West African mining shares, with a boomlet in American Rails thrown in by way of a side-show, attracting little business. It is in mines that the great body of the public is taking most interest, and the demand for capital to finance the rise has an appreciable effect upon money rates. Investment departments suffer from neglect, so that realisations on behalf of several large deceased accounts have had more influence upon prices than would have been the case in more normal circumstances.

Almost the only item of animation amongst Home Railway stocks is a gamble which is proceeding in East London Ordinary. The stock was indicated here last week as a good speculative purchase at 3¾, but the price had risen before the paper appeared, and has been up to 4½, returning to 4⅛. Rather than pay this price, it would seem better to take the "D" Debenture stock at about 5½. The two other low-priced Debentures are the "C" at 7½ and the "B" at 26. All of them are, of course, just gambling counters, dependent for their movements upon the chances of the East London line being electrified, or taken under the more direct control of one of the six companies interested in the little undertaking. What chance there is of the line being taken in hand immediately we do not know. The market laughs at such an idea, and the officials of the company disclaim all knowledge of it.

Reminiscence begs leave to interpolate the observation that every announcement of an American Railroad going into a receivership was invariably heralded by positive assurances on the part of the officials that the company was never in better condition, and never farther removed from default. From which the moral might be suggested that too great heed must not be paid to official utterances.

Districts and Metropolitans receded a little, and Central London stocks are dull, the Ordinary and Deferred both giving way. City and South London rose 1. Underground Electric Railway 4½ per cent., and the 6 per cent. Income bonds have hardened, although the 5 per cent. prior lien bonds are back to 101½. London United Tramways Preference fell 5s. to 2½, the traffic being hindered for several days by last week's severe fire in King Street Hammersmith.

The Mexican-Canadian group is distinctly flat. Mexican Light and Power went back 4, after its rally upon Dr. Pearson's comforting cable with references to the rumours of drought—damage being much exaggerated. The 5 per cent. Gold bonds recovered ½ after their drop of 5½, the price now standing at 88½ middle. Mexico Trams further declined, and the bonds are lower at 94. Rio Trams weakened to 100, while Sao Paulo Trams maintained their price at 157. Kaministiqua Power 5 per cent. Gold bonds rose to 100½, and Electrical Development of Ontario 5 per cent. Debenture stock went back to 90.

It is understood that the issue of Bombay Electric Supply and Tramways Second Mortgage Debentures met with a somewhat cool response from the public. Underwriters are likely to be called upon to take about 50 per cent. of their obligations. The price of new stock is 1 discount to par.

There is not a gleam of business or interest in electricity supply shares. County Preference and Westminster Ordinary are ⅛ down, while River Plate Preference rose 1/16 to 1⅛. No other changes have occurred. Kalgoorlie Electric Preference are firm at 16s. 3d., and the Ordinary are being dealt in about 5s. 6d.

Telegraph descriptions are lower on balance. Another sharp drop occurred in Anglo-American Deferred, weak holders being shaken out on the eve of the carry-over. This affected the prices of the Ordinary and the Preferred stocks, both of which fell. Cuba Telegraph shares are ⅛ lower, and Eastern Telegraph Ordinary reacted. Eastern Extensions dropped to 12. West India and Panama fell ¼; so did Western Telegraph shares. The proceedings at Monday's meeting of the Press Conference, at which considerable stress was laid upon cheap cables, has damaged the Telegraph market, but Marconi's are 2s. 6d. up at 16s. 3d., and business has been marked this week as high as 17s. 3d. National Telephone Deferred stock fell sharply. Anglo-Portuguese Debenture retained its rise, the just-issued report showing satisfactory expansion in business and profits.

Cape Copper Co.—Interim dividend, 1s. 6d. per share, tax free, on the cumulative preference and ordinary shares, payable on July 1st.

SHARE LIST OF ELECTRICAL COMPANIES

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations June 1st.	Closing Quotations June 8th.	Business done week ended June 8th, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2⅞— 3⅛	2⅞— 3⅛	..	..	..	Nil.
136,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	94 — 96	94 — 96	..	..	..	5 4 0
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½ %	8 %	8 %	8 %	143½—144¼	143½—144¼	..	..	..	5 10 9
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	98½—100½	98¼—100½	..	..	..	3 19 7
598,180	Anglo-American Telegraph	Stock	3½%	3½%	3½%	£3 4s.	58 — 60	57 — 59	58½	57½	—1	5 6 5
3,200,910	Do. do. do. 5 % Pref.	Stock	6 %	6 %	6 %	6 %	101 —102	99 —100	101½	99½	—2	6 0 0
3,200,910	Do. do. do. Deferred	Stock	1½	1⅝	1 %	8/-	16⅞— 17⅛	16 — 16½	17⅛	16 7/16	— ⅞	2 8 2
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	99½—101½	100 —102	..	..	+ ⅛	4 8 2
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	8 — 8⅛	8 — 8⅛	..	..	..	4 15 6
2,481,350	Commercial Cable, Sting. 500 year 4% Deb. Red.	Stock	4 %	4 %	4 %	4 %	91¼— 93¼	91 — 93	91⅜	91¼	— ⅛	4 6 0
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8¼— 9	8⅛— 8⅜	8¼	..	— ⅛	6 15 6
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11 1
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	2⅞— 3⅛	2⅞— 3⅛	..	..	..	5 3 8
5,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8¼— 9	8¼— 9	..	..	..	5 11 1
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	2 16 6
60,710	Direct United States Cable	20	4½%	4½%	4½%	4½%	12⅜— 13⅛	12⅜— 13⅛	12½	..	..	6 8 4
48,000	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..	4 7 5
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	134½—136¼	132 —135	135	133½	—2	5 3 8
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	85½— 87	85½— 87	87	86½	..	4 0 6
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	103 —105	103 — 105	104	103½	..	3 16 2
800,000	Eastern Extension, Australasia, and China Tele	7	7 %	7 %	7 %	7 %	12⅜— 12½	11⅜— 12⅛	12⅜	12⅛	—⅛	5 14 3
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	101⅛—103½	101⅛—103½	102	..	..	3 17 4
200,000	East. & S. Afric. Tel., 4 % Mt. Db. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	99 —101	100 —102	..	..	+1	3 18 5
181,127	Globe Telegraph and Trust	10	5⅓%	5⅓%	5⅓%	5⅓%	10⅞— 11⅛	10⅞— 11⅛	11⅛	10⅞	— ⅛	5 2 8
181,127	Do. do. 8 % Pref..	10	8 %	8 %	8 %	8 %	12⅝— 13⅛	12⅝— 13⅛	13⅛	13	— ⅛	4 10 7
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	27 — 28	27 — 28	28¼	..	..	6 8 7
14,800	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..	4 7 5
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	51½— 53½	51½— 53½	..	..	..	6 1 6
$41,880,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	78 — 82	78 — 82	..	..	..	4 17 7
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	73 — 76	74 — 77	..	..	+2	5 1 3
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	⅜— ½	⅜— ⅞	17/3	15/3	+ ⅛	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	¾— 1	¾— 1	18/8	..	..	6 0 0
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	¾— ⅞	¾— ⅞	..	..	..	5 12 11
1,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	107 —108½	107 —108½	107⅝	107	..	5 10 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	123 —124½	120 —122	124½	120½	—2½	4 18 4
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10½— 11	10½— 11	..	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10½— 11	10½— 11	..	..	..	5 9 1
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜— 5⅝	5 5/16— 5 7/16	5⅜	5 5/16	—1/16	4 5 3
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	..	..	..	3 10 0
1,716,698	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	101⅞	..	..	3 18 5
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1 1/16— 1 1/16	1 1/16— 1 1/16	..	..	..	5 6 8
50,000	Do. do. do. 6 % Cum. Pref....	1	6 %	6 %	6 %	6 %	1 1/16— 1 1/16	1 1/16— 1 1/16	20/10½	..	..	5 1 1
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	88 — 90	88 — 90	..	..	..	4 8 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 11 7
11,689	Reuter's	8	5 %	5 %	5 %	5 %	7⅞— 8¼	7⅞— 8¼	..	..	..	4 18 9
99,100	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100—102	100 — 02	..	..	..	4 8 3
8,083	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	127 —130	128 —131	..	..	+ 1	4 11 7
120,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6¼— 7⅛	6¼— 7⅛	7 1/16	6 13/16	..	5 12 8
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5 — 5⅜	5 — 5⅜	..	..	..	4 18 0
80,008	W. Coast of America, 1 to 80,000 & 53,001 to 53,008	2½	Nil	2½%	2½%	..	1⅛— 1⅜	1⅛— 1⅜	23/9	..	..	4 10 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	..	12⅜— 14⅜	13⅛— 14	14⅛	13⅝	—⅛	5 0 0
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 —103	101 —103	102½	101½	..	3 17 6
88,831	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅜— ½	⅜— ½	..	..	..	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	8¼— 9⅛	8¼— 8⅝ xd	..	..	..	6 7 2
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8 — 9	8 — 9	..	..	..	
80,000	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	102 —101	102 —104	..	..	..	4 18 2

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

320,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,007	5	8 %	8 %	9 %	10 %	9 7/16— 9 11/16	9⅜— 9½	9 11/16	9¼	— 1/16	5 2 7
580,007	Do. 6 % Cum. Prefs., 1 to 260,007 ..	5	5⅛%	5⅛%	6⅛%	6 %	6⅛— 6⅜	6⅛— 6⅜	5 5/16	6 1/16	..	4 14 1
978,280	Do. 4 % Deb. Stock	..	..	..	..	..	94 — 96	94 — 96	94½	..	..	4 6 6
285,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 2
880,000	Babcock & Wilcox, 1 to 880,000..	1	20 %	20 %	20 %	20 %	4⅛— 4½	4 1/16— 4 3/16	90/-	88/11½	+ 3/16	4 7 4
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅛— 1⅜	1⅛— 1⅜	..	..	..	4 0 0
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	1— 1⅛	1 — 1⅛	..	..	+ ⅛	22 5 2
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	2— 2⅛	2⅛— 2⅜	42/6	..	+ ⅛	18 5 0
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3¾— 4	3¾— 4	..	..	..	7 10 0
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	3¾— 4⅛	3¾— 4⅛	..	..	..	4 8 11
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	95 —100	95 —100	..	..	..	5 10 0
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	142 —146	143 —147	..	..	+1	5 8 10
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	123 —127	123 —127	125½	124½	..	4 14 2
300,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	109 —112	109 —112	110½	..	..	4 9 2
288,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	101 —103	102 —104	..	..	+1	4 6 7
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
188,301	British Electric Traction	10	3 %	Nil	Nil	..	¾— 1 1/16	¾— 1⅛	..	..	..	Nil
161,487	Do. do. 6 % Cum. Pref.	10	6 %	6 %	3 %	..	2⅛— 2⅜	2⅛— 2⅜	..	..	..	3 17 9
1,478,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	89 — 93	89 — 93	92½	90½	..	5 7 6
525,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	68 — 72	68 — 72	68½	..	..	6 5 0
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7⅞— 7⅞	7⅞— 7⅞	..	..	..	6 9 0
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6¼— 6⅜	6¼— 6⅜	..	..	..	4 7 3
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
204,940	British Thomson-Houston 4½ % 1st Mort. Debs.	100	4½%	4½%	4½%	4½%	91 — 96	91 — 96	..	..	..	4 16 11
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	¼— ⅜	¼— ⅜	7/-	..	..	Nil
1,616,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	40 — 44	40 — 44	..	..	..	9 1 8
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	3/16— 1/4	3/16— 1/4	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	2½%	Nil	Nil	Nil	0 — ¼	0 — ¼	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref. ..	2	6 %	Nil	Nil	Nil	0 — ¼	0 — ¼	..	..	..	Nil
125,000	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	43 — 48	43 — 48	..	..	..	9 8 6
125,000	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	29 — 33	29 — 33	..	..	..	13 13 8
187,610	Calcutta Trams, 1 to 137,610	5	8 %	8 %	6 %	..	4⅛— 4⅜	4⅛— 4⅜	93/9	90/-	..	6 6 4
45,204	Do. 5 % Cum. Pref., Nos. 1 to 39,880..	5	5 %	5 %	5 %	5 %	4⅛— 5⅛	4⅛— 5⅛	98/9	..	..	4 15 3
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	100 —103	100—103	101	..	..	4 7 5
95,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	..	9⅜— 10⅛	9⅜— 10⅛	10½	..	+ ⅛	7 2 10
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5⅛— 5⅜	5⅛— 5⅜	..	..	..	4 8 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105 —107	105 —107	..	..	..	4 4 1
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	..	⅛— ¼	⅛— ¼	5/-	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	..	1⅛— 1⅝	1⅛— 1⅜	32/6	..	..	6 3 7
210,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	..	102 —106	102 —106	104½	..	..	4 4 11
1,898,610	Central London Railway, Ord. Stock..	Stock	4 %	4 %	2 %	2½%	68 — 70	66 — 68	69	66	..	4 15 7
658,195	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	..	..	..	4 12 0
658,195	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	51 — 53	50 — 53	53	..	—1	4 16 2
1,480,000	City and South London Railway	Stock	1¾%	2½%	2½%	1¾%	31½— 32½	32½— 33½	34	33½	+1	4 9 7
85,000	Crompton & Co., Nos. 1 to 85,000	5	3½%	5 %	5 %	5 %	1 — 1⅛	1 — 1⅛	..	..	..	0 7 6
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £186, and 901 to 11,089 of £60 Red.	..	5 %	5 %	5 %	5 %	95 — 98	95 — 98	..	..	..	5 2 0

* Unless otherwise stated, all shares are fully paid † A period of nine months. ‡ From Manchester Share List

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations June 1st.	Closing Quotations June 8th.	Business done week ended June 8th, 1909. Highest	Lowest	Rise + or Fall −	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	..	8 0 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 3/32 — 1 5/32	1 3/32 — 1 5/32	..	..	..	4 16 0
276,880	Do. dc. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	13— 14	13 — 14	12¾	..	..	4 5 9
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4½%	4½%	2½%	..	1/4 — 5/16	1/4 — 5/16	..	..	..	15 0 0
17,139	Do. "A" shares, 01—017,139	5	4½%	4½%	2½%	..	1¼ — 2⅛	1¼ — 2⅛	..	..	..	5 0 0
317,875	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	70 — 75	70 — 75	..	..	..	5 6 8
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	..	84 — 87	84 — 87	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	3/32 — 5/32	3/32 — 5/32	..	..	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890	2	7 %	7 %	7 %	7 %	1 — 1¼	1 — 1¼	21/-	..	..	11 4 0
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	7/8 — 7/8	7/8 — 7/8	..	..	..	6 9 0
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	85 — 88	85 — 88	..	..	..	4 10 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	½%	Nil	1/2 — 3/4	1/2 — 3/4	13/9	..	..	6 13 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10½ — 10¾	10½ — 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —108½	102 —108	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	11⅜ — 12⅜	11⅜ — 12⅜	..	..	..	6 1 2
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	4⅜ — 5/8	5 — 5/8	5	..	+ ⅛	4 3 9
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	104 —106 xd	104 —106	..	..	..	4 5 9
60,000	India-Rubber, Gutta-percha & Telegraph Works.	10	10%	10 %	10 %	..	14½ — 15½	14½ — 15½	..	..	..	6 11 2
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	1/8 — 1	1/8 — 1	..	..	— 1/16	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	5 — 6	5 — 6	..	..	..	8 6 8
600,070	London United Trams. (1901), 1 to 60,007	10	3 %	3 %	3 %	Nil	2 — 3	1½ — 2½	..	..	..	4 8 11
899,980	Do. do. 60,008 to 100,000	10	3 %	3 %	3 %	Nil	3¼ — 4	3 — 4	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3⅔%	2¼ — 2½	2 — 3	57/6	50/-	— ½	12 10 0
1,881,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	70 — 74	70 — 74	..	..	..	5 8 1
5,782,082	Metropolitan Consolidated	100	2⅜%	1 ⅜%	⅜%	⅜%	38⅜ — 39¼	38 — 38½	39	38	— ⅜	1 6 0
2,640,914	Do. Surplus Lands	100	2⅜%	2⅜%	2⅜%	2⅜%	70 — 72	69 — 71	70	..	—1	3 17 6
3,285,000	Do. District	100	Nil	Nil	Nil	Nil	16½ — 17	16½ — 16⅔	1⅛	16½	— ½	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	2/8 — 3/8	2/8 — 3/8	..	..	..	..
314,016	Do. do. Defd.	1	Nil	Nil	Nil	Nil	3/8 — 4/8	3/8 — 4/8	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	3/8 — 4/8	3/8 — 4/8	..	..	..	5 19 5
600,000	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	97 — 99	98 — 100	99½	98	+1	4 10 0
$6,000,000	Mexico Trams Co., Common Stock	..	..	..	..	..	148 —150	146 —148	151½	145⅔	—2	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	95 — 96	93 — 95	96½	94½	—1½	5 5 3
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	1/8 — 1/4	1/8 — 1/4	..	..	..	8 13 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1/4 — 3/8	1/4 — 3/8	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	86 — 89	86 — 89 xd	..	..	..	5 1 2
87,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	32½ — 34	32½ — 34	32½	..	..	6 0 0
150,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	..	101½—102½	101 —102	..	..	..	..
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	88 — 90	89 — 91	90¾	89⅔	+1	4 18 11
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	36 — 38	37 — 39	37⅔	..	+1	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	3/8 — 7/8	3/8 — 7/8	..	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	2 3/16 — 3 5/16	2 3/16 — 3 5/16	61/8	..	..	7 15 6
246,404	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	76 — 80	76 — 78	78	..	..	5 0 0

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4¼— 4⅜	4¼— 4⅜	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 13 9
80,275	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10 %	10 %	8½ — 9	8½ — 9	8⅝	..	..	5 11 1
9,725	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	8 — 8½	8 — 8½	..	..	..	4 2 4
886,276	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	97 —100 xd	97 —100	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3⅞ — 4⅛	3⅞ — 4⅛	..	..	..	5 14 3
80,000	Do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅛ — 4¼	4⅛ — 4¼	..	..	..	4 13 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3¾ — 4¼	3¾ — 4¼	89/4½	77/6	..	5 5 11
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..	3 19 3
49,486	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅝ — 4⅛	3⅝ — 4⅛	81/3	..	..	5 9 1
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102 —105	102 —105	104	103½	..	4 5 9
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅝ — 11	10⅝ — 11	10⅞	..	..	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11⅜ — 12½	11⅜ — 12½	..	..	..	4 16 0
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —123	121 —123	..	..	..	4 1 4
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	2⅜ — 3⅛	2⅜ — 3⅛	..	..	..	8 6 8
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	3¼ — 3⅜	3¼ — 3⅜	..	..	..	6 13 4
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	96 — 98	96 — 98	..	..	..	5 2 0
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	8¼ — 8⅝	8⅛ — 8⅜	8⅞	8¼	— ⅛	5 14 3
50,997	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅞ — 11¼	10⅝ — 11⅛	10⅞	10⅜	— ⅛	5 5 8
400,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	106 —109	106 —109	108½	106½	..	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	101⅛	101½	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	Nil	1/8 — 3/8	1/8 — 3/8	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	3 %	Nil	Nil	3/8 — 5/8	1/8 — 3/8	..	..	..	Nil
480,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	60 — 63	60 — 63	..	..	..	7 2 10
$3,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	..	5 %	89 — 91	88 — 90	89½	88⅔	—1	5 11 1
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4¾ — 5	4¾ — 5	..	..	..	5 10 0
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 — 100	97 —100	..	..	..	4 10 11
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7½ — 7⅞	7⅜ — 7⅞	..	..	..	5 9 8
$2,400,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	99 —101	99 —101	100½	100½	..	5 4 11
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	8 %	7⅞ — 7⅞	7⅞ — 7⅞	7⅞	..	..	6 1 8
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94 — 97	97 — 100	..	..	+3	4 0 0
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅞ — 2⅛	1⅞ — 2⅛	2 1/16	..	..	4 16 0
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	5 11 8
874,886	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	92 — 96	92 — 96	..	..	..	4 3 4
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4⅜ — 4⅝	4⅜ — 4⅝	..	..	..	5 5 3
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅜ — 5⅛	4⅜ — 5⅛	5	..	..	4 5 9
220,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	107 —110	107 —110	..	..	..	4 1 10
248,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	85 — 88	85 — 88	..	..	..	3 19 7
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	86½ — 88½	86 — 88	88	..	— ½	5 13 8
18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	3½%	76 — 78	72 — 74	77	72½	—4	4 14 7
$1,500,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	109 —111	108 —110	111½	108	—1	6 7 3
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	87 — 89	87½ — 88½	91	88½	..	5 13 0
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
87,500	Newcastle-on-Tyne, 1 to 87,500	5	8 %	8 %	8 %	2½%	4⅜ — 5	4⅜ — 5	..	..	..	2 10 0
87,500	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	5 %	4¾ — 5⅛	4¾ — 5⅛	..	..	..	4 15 8
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	99 — 101	99 —101	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	11¼ — 12½	11¼ — 12½	..	..	..	5 12 0
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	6 %	8 %	1⅜ — 1½	1⅜ — 1½	28/3	27/9	..	5 6 8
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 1/16 — 1 1/8	..	..	+ 1/16	5 1 1
104,684	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —107	103 —107	105	..	..	4 13 6
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	9 — 9⅛	9 — 9⅛	9⅛	..	..	6 13 4
80,000	Do. do. 7 % Pref. 20,061 to 40,060	5	7 %	7 %	7 %	7 %	7 — 7⅛	7 — 7⅛	7⅛	..	..	4 13 4
450,000	Do. do. 3½ % Deb. Stock Red.	100	3 %	3½%	3½%	3½%	86 — 90	86 — 90	..	..	..	3 17 9
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	3/8 — 7/8	3/8 — 7/8	..	..	..	Nil
85,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅜ — 2⅝	2⅜ — 2⅝	..	..	..	6 9 0
20,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	1/16 — 3/16	1/16 — 3/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 1/16 — 1 3/16	1 1/16 — 1 3/16	..	..	..	5 6 8
220,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 0 0
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	3/8 — 1	3/8 — 1	..	..	..	25 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	2 — 2½	2 — 2½	42/6	..	..	10 0 0
75,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	80 — 84	80 — 84	..	..	..	5 7 2
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	5 %	3/4 — 7/8	3/4 — 7/8	18/11½	..	..	..
110,000	Westminster Electric Supply, Ord.	5	12 %	12 %	10 %	10 %	9 — 9⅜	9 — 9⅜	9 3/8	9 3/8	— ⅛	5 5 8
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1908)	5	5 %	4½%	4½%	4½%	5⅛ — 5⅜	5⅛ — 5⅜	5⅜	5 1/16	..	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 2½ per cent., April 1st. 1909.

SEVENTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY.

(*Concluded from page* 916.)

THE next paper was read by Mr. M. Bodenstein, and dealt with the production of the red oxides of nitrogen from nitric oxide. This is a question which has become of considerable importance, since attention has been directed to the fixation of atmospheric nitrogen. A paper was also read by Mr. A. Rosenheim on the electrolytic reduction of molybdic acid, but this was chiefly of chemical interest. After this Prof. Bernthsen presented his paper on behalf of the Badische Anilin und Soda-Fabrik. Beyond all doubt this was the chief lecture of the meeting. The production of nitric acid and nitrogenous products is a subject of prime importance. The necessity for a cheap supply of fertiliser increases annually, whereas the hitherto known sources are fast being depleted. Sir William Crookes in his treatise entitled "The Wheat Problem," states that "the fixation of atmospheric nitrogen is one of the greatest discoveries awaiting the ingenuity of chemists. It is certainly deeply important in its practical bearings on the future welfare and happiness of the civilised races of mankind." The annual consumption of saltpetre for agricultural purposes grows rapidly; at the present time it is nearly 2,000,000 tons, and it is estimated that the supply will be exhausted in some 30 or 40 years. In addition to this, the yearly increase in consumption averages some 50,000 tons, with the natural result that the cost is gradually rising. It is essential that new sources of supply should be opened up, and none is more suitable than the atmosphere. Allowing for an increase of consumption in our present standard, there is sufficient nitrogen in the air to last for 14,000,000,000 years, even supposing that none is returned.

From this point of view the supply may be regarded as unlimited for all practical purposes. The method of fixing this nitrogen is similar to the process that takes place naturally during a thunder shower. An electric discharge through the atmosphere produces nitric oxide, which, in turn, is converted to nitrogen peroxide by the atmospheric oxygen. These red oxides of nitrogen are soluble in water, producing nitric acid, from which any desired nitrate may be obtained. The two essential features of the method required are the production of a very high temperature and a quick and efficient cooling arrangement. The novelty in this new process is the production and maintenance of a suitable electric flame. This is accomplished in an entirely new manner. The arc is struck in an iron tube, which may be designated the arc tube. This contains an insulated electrode at one end, and can itself serve as the second electrode. The arc at its formation springs from the insulated electrode to an adjacent part of the arc tube, which is only a short distance away, but the air current, which is passing through the tube with a rotary motion, immediately carries the arc along the wall of the tube, so that it either enters the tube at a considerable distance from the electrode or ends in a special electrode placed for the purpose. A slight modification consists in using an arc tube of non-conducting material, such as glass, and inserting a wire spiral along which the end of the arc can travel. In either case a column of arc flame burning quietly in the axis of the tube is formed, surrounded by air which is being passed through the tube. This was actually demonstrated on the lecture table, and a beautiful arc was obtained quite a yard long. It emitted an intense light, and burned quite steadily. Air passing through the tube comes into contact with the arc, becomes partially converted to nitric oxide, and then is rapidly cooled down by contact with the outside layers of air and so avoids decomposition. The cooling action is still further increased by surrounding the upper end of the arc tube with running water. The gases leaving the upper end of the arc tube contain about 2 per cent. of nitric oxide, which is nearly twice as concentrated as the gases which Birkeland and Eyde produce. In a practical demonstration, the air issuing from the arc tube was collected in a series of globes, which became intensely coloured red in a few moments due to the presence of fixed nitrogen. This invention is due to Schönherr, who was assisted by the engineer Herrberger. The apparatus is capable of absorbing immense quantities of power. Furnaces can be built capable of taking 2,000 H.P., but those in regular use will be designed for 1,000 H.P. The furnaces require 40,000 cb. ft. of air every hour, and the arcs produced are nearly 8 yards long. These large furnaces are constructed of iron, the air passing in through a number of tangentially bored holes in a part of the tube surrounding the electrode. The insulated electrode is provided with a central hollow space through which passes an iron rod. The arc actually springs from this rod, which, as it burns or volatilises away, can be pushed further in; the rate of burning, however, is very slow. An ignition lever is provided, so that the arc can be started afresh, should it from any cause become extinguished, which, however, is very rarely the case. The furnace is connected to earth, and can be handled with impunity. The gases leave the arc tube and pass down a channel lined with brick, concentrically surrounding the inner parts of the furnace. In this manner their heat is utilised for preheating the incoming air. Only a few per cent. of the total electrical energy of the arc is utilised in the actual chemical fixation of nitrogen, the rest being radiated in the form of heat. This, however, is not lost; 30 per cent. of it is employed for producing hot water, 40 per cent. heats the boilers, and only 17 per cent. is lost. The gases issuing from the arc tube are dissolved in water or milk of lime, and made chiefly into fertilisers. Part, however, is converted to nitrites for use in the dye trade. Since 1907 the Norsk Hydro-Elektrisk Kvaelstof Aktieselskab, the company founded by Birkeland and Eyde, has joined hands with the Badische company, and two new Norwegian companies have been floated. The first is a power company with a capital of 16,000,000 kronen, and the second—the Norsk Salpeterverker—with a capital of 18,000,000 kronen, concerns itself with the running of saltpetre factories. The first factory of the new company will be situated in the interior of Telemarken, on the Rjukan, where power to the extent of 250,000 H.P. is being developed. The saltpetre will be carried along 29 miles of new normal-gauge railway, and by ferry along Lake Tin, a distance of 25 miles, until it reaches Notodden. Here it will be transported *via* Skien to the sea. Other water-power is held in reserve in Norway, and an attempt is being made to acquire 50,000 H.P. in Bavaria. Similar negotiations are being made in England, but the acquiring of a suitable site is a matter of some difficulty. At Notodden there are at present 35 Birkeland furnaces in operation. The new plant will be completed in two years, and in the near future the annual output will reach 100,000 tons. It was distinctly pointed out that cheap water power is essential to success. Furthermore, no demoralisation of the saltpetre market is likely. There is room for all, and even more. A second development of the electric flame arc is the production of waves of high frequency, and the method of utilising these in wireless telegraphy has been discovered and patented. In conclusion, Birkeland read an abstract of a paper on his process, but this has been already described in the English journals.

Following these, a paper was read by M. Caro on the cyanamide process. As is quite well known, this is the second industrial method of fixing atmospheric nitrogen. It consists of heating together a mixture of calcium carbide and atmospheric nitrogen. The product is sold as a fertiliser, or is converted into ammonium sulphate or treated by some chemical process to convert it into useful products. No other papers were read during the meeting, but abstracts were available.

After the excitement of Saturday's meeting comparative quiet reigned again on Monday morning. The papers of Section X were, nevertheless, of a most interesting nature, and in many cases discussion was followed with great enthusiasm. The programme was somewhat extended, and great difficulty was experienced in getting through all the matter in the time allotted. The following list of papers gives the programme for the morning:—

"Electrolysis of Brine with the Finlay Cell," by *F.* G. Donnan and R. Finlay.

"Processe der Kochsalz-Elektrolyse," by R. Taussig.

"Three Years' Practice of the Townsend Cell," by Dr. L. H. Backeland.

"The Function of Refrigeration in the Liquefaction of Chlorine," by E. A. Sperry.

"Chlorine Detinning in Practice," by E. A. Sperry.
"Study upon the Utilisation of Electrolytic Chlorine for the Simultaneous Production of Hydrochloric and Sulphuric Acids," by A. Cappadoro.
"Contribution à l'Electrolyse des Solutions Salines avec Anode de Zinc," by E. Leriche.
"Procédé de Fabrication Electrolytique du Blanc de Zinc," by E. Leriche.
"Passivity of Metals," by Kistiakowsky.
"Ueber anormale Rotationsdispersion," by Tschugaeff.
"Experiments to Prove that Electro-Deposited Copper has a Similar Crystalline Structure to Cast Copper," by S. Cowper-Coles.
"Physical Chemical Notation," by Report of Committee.
"The American Car Lighting Storage Battery," by American Car Co.
"Influence de la Viscosité du Milieu sur les Valeurs de la Surtension Cathodique," by C. Marie.
"Reserches sur la Dépolarisation," by C. Marie.
"Chemische Kette," by B. Kuriloff.
"Electrical Testing Laboratories," by C. H. Sharp.
"Electrolyse della Santonini," by E. Pannani.
"A New Aspect of the Electrolytic Dissociation Theory," by N. Bjerrum.
"Sur une Nouvelle Application de l'Electricité au Travail Chimique de la Laine," by J. Harding.

The first paper was read by Prof. F. G. Donnan, in which the Finlay cell was described and various efficiency curves reproduced. This has, however, been given quite recently. The next paper was contributed by Mr. L. H. Baekeland, and aroused the greatest interest during the meeting. Much new information was brought to light regarding the Townsend cell for producing caustic alkali. The cells now in use are designed for 6,000 amperes with a current density of 150 amperes per sq. ft., and a pressure of 4·5 volts. The maximum flow of liquor from the cell is 30 litres per hour, but the average is about 25 litres. The concentration of this liquor is 14-15 per cent. of caustic alkali, which represents an ampere efficiency of 93 per cent. The diaphragms require cleaning every 30 days, but this takes only a few minutes in the present cells. Under the new conditions of working the anodes corrode slightly, and require renewing occasionally. Other parts of the apparatus are equally durable. The evaporating pots last well, the cost of renewals throughout being small. The caustic alkali ready for sale contains 94 per cent. alkali, 4 per cent. salt, and small quantities of other substances. The chlorine gas is 93-97 per cent. pure, impurity being due chiefly to the air which leaks into the apparatus, owing to the slight negative pressure of the normal working conditions. As the author pointed out, the figures now given are those obtained from the book-keeper, and not from estimates. This is the only reliable test of the successful working of a process.

Following the above communication, two interesting papers were presented by Mr. Sperry on the method of utilising the electrolytic chlorine of the Townsend cell. The first dealt with the liquefying of the gas to make it anhydrous. This anhydrous gas is then used for the production of pure scrap iron and tin salts from old tin plate. This latter method costs only half that of the electrolytic detinning process, and is far more efficient. This paper created a somewhat heated discussion as to whether it is industrially possible to work a detinning process successfully. Another paper dealing with electrolytic chlorine was presented by Mr. Cappadero, who proposes to convert it into a mixture of sulphuric and hydrochloric acids.

The next two papers also dealt with problems of electrolysis. After this Mr. Kistiakowsky gave a very interesting paper on passivity. This question is of great importance in these days of vagabond currents and steel structures. The author showed, for example, how it is possible to put such an easily corrodible metal as magnesium into a passive state even in very strong acids. The paper of Cowper-Coles presented nothing new, but was listened to with great attention. The communication of the General Storage Co. is of great interest, as it deals with the problem of electric lighting in railway cars. At the present time three general systems are in use in the United States. These in order of importance are the axle-driven generator system, the "head-end" system and the straight-storage system. The first system is mostly in use. Each car carries its own dynamos, driven by a belt from a pulley on the car axle, the necessary regulating apparatus and a battery. The generators are of various ratings, from 1 KW. to 3 KW, or more, and are usually of the fully enclosed type. The usual armature speed is about 1,300 R.P.M. One of two voltages is usual, viz., 60 or 30 volts. With the former a battery of 32 cells is provided. In the "head-end" system the generator is driven by a steam engine supplied from the locomotive. A constant pressure system is used, and the current is conducted the entire length of the train by a three-wire "train line." The voltage used is 110 volts, and the generators have two capacities, 15 and 25 KW. In the straight-storage system the batteries are charged only at the termini, and are generally used on 60-volt circuits with a battery capacity of 300 to 400 ampere-hours. The remaining papers of the morning were of interest chiefly from a theoretical standpoint.

Following the various sectional meetings of Monday morning, a general lecture was delivered by Prof. Witt, the subject being "Evolution in Applied Chemistry." This was of general interest, and was followed with pleasure by a fully representative audience. It was pointed out that the simple daily wants of mankind in a primitive state were supplied by nature. The progress of civilisation, however, necessitated a transformation of these gifts, which culminated in the birth of industrial chemistry. In this manner there arose a new creation, which was helped along its way by sound empiricism. Nature was forced to divulge her innermost secrets, and empiricism was quite content to pick up the treasure it might come across in its ramblings through the unexplored regions of science. New fields were continually being opened, and the process was as active to-day as ever. An example of this evolution is to be found in Norway at the present time. A new chemical industry of vast dimensions is being exploited which differs fundamentally from those of older commercial centres. Its factories will have no chimneys, nor fires. They will be operated by "white coal," the force of roaring waters. The problem before older engineers was to convert heat into electricity, but in Norway the exact reverse is required. The history of applied chemistry is teeming with examples where the survival of the fittest meant neither more nor less than a victory of economy.

After the above interesting lecture, meetings in the various Sections were again commenced. For Section X the following programme was issued, seven of the authors communicating their papers :—

"Thermo-Chemistry of Furnace Reactions," by W. N. Hartley.
"That a Uniform System of Thermo-Chemical Notation be Adopted," by W. N. Hartley.
"A New Thermo-Chemical Notation," by J. H. Pollok.
"A Recording Thermo-Electric Calorimeter," by C. Fery.
"Cooling Curves and a New Type of Apparatus for their Registration," by E. F. Northrup.
"Revision des Chaleurs de Combustion et des Consequences," by M. Lemoult.
"The Density and Atomic Heat of Zirconium," by J. Wedekind.
"Thermic Reactions in Vacuo," by H. R. Ellis and F. E. Weston.
"Zur Frage nach der Temperaturabhängigkeit der Valenz," by W. Biltz.
"Dissociation of Calcium Carbonate," by E. H. Riesenfeld.
"Molecular Combinations," by B. N. Menschutkin.
"Theoretisches und Experimentelles über die krystallinischen Flüssigkeiten," by Prof. Bose.
"Terres rares. Separations, Determinations des constants qui les Definissent, Poids Atomiques, Emission, Absorption, &c.," M. Urbain.

From an electrical standpoint, the paper of chief interest was No. 4, which was presented in abstract by Dr. C. V. Drysdale. In this a new recording calorimeter was described. The essential details of structure are as follows :—A thermopile is constructed of strips of iron and of constantan, each of which forms two sides of a rectangle, and is riveted and hard soldered to the next element. The result is a rectangular spiral of 15 elements with one set of junctions at the top, and the other set at the bottom. Insulating strips of mica are inserted along the vertical sides of the spiral, which is clamped between two asbestos boards by means of metal frames. The whole arrangement thus forms a lamp chimney. The flow of air takes place between the strips at the bottom and the top where the mica insulation is absent. In operation cold air enters at the bottom, passing through the cold junctions to a combustion jet. The hot products of the flame then traverse the interstices between the top strips, and the E.M.F. developed by the pile indicates the rise of temperature resulting from combustion. The resistance of the pile is low, and the power produced is sufficient to obtain a trace on a recording instrument. The

galvanometer is a very robust double-pivoted instrument, the pointer of which carries the recording pen. The results obtained are uniformly good, and compare very closely with the theoretical values. The apparatus is constructed by the Cambridge Scientific Instrument Co. and the Cie. pour la Fabrication des Compteurs et Materiels à Usines à Gaz. It is unfortunate that the author of the fifth paper was absent, and members had to be content with a printed abstract. In this a new type of autographic recorder is described, but in the absence of diagrams it is impossible to elucidate the underlying principles of the instrument. To the remaining papers of the meeting no great electrical interest is attached.

On Tuesday another long list of papers was read by the various authors of Section X. The day, however, was devoted chiefly to general physical chemistry, and only a few communications came within the region of electrotechnics. The first paper of interest was presented by Messrs. Brodit Boiteau and E. Paunani on the electrolytic transformation of ammonia into nitrates. This is one of the problems which have arisen out of the fixation of nitrogen for manural purposes. So far no process has been developed on an industrial scale, but the results are of great scientific interest. Mr. E. C. Szarvasy also presented a very interesting communication on the corroding of aluminium in alcohol. Incidentally, a method has been developed for plating aluminium, which up to now has been one of the many unsolved problems. The bath employed is a solution of a dry copper, nickel or tin salt in anhydrous methyl alcohol. The aluminium to be plated is thoroughly cleaned with a metal polish containing fats. The object of the fat is to protect the clean metal surface from atmospheric oxidation. The metal is then introduced into the bath, the alcohol dissolves the fat, and copper, nickel or tin is deposited in an adherent form on the aluminium surface. A third paper on the list was presented by M. La Rosa, on the fusion of carbon in the electric arc. During the afternoon meeting also a long list of communications was read, and the Section finally came to the end of its lectures. This ended the real business of the Conference, but the official close did not take place until the next day. Without hesitation it can be stated that the Conference has been a great success, and the Managing Committee is to be congratulated on the interesting matter which has been brought together.

OUR NATIONAL INDUSTRIAL WEAKNESSES.

With Notes on the Revival of Trade.

(*Concluded from page* 944.)

In his speech at the dinner of the National Liberal Club last week, Mr. John Burns, M.P., said that, feeling the pulse of industry and commerce as he was able to do at the Local Government Board, he found that trade revival was upon us. He hoped that concurrently with revival tradesmen would regain hope.

In the *Literary Digest*, of New York, received by this week's mail, the leading article is entitled "Prosperity Not Waiting for the Tariff," and the following extract therefrom will show that in America there is a general awakening :—

"Sanctioned by some of the most influential names in the business world, a crescendo note of optimism is heard of late from the columns of the daily Press. We are assured by dispatches that such giants among industrial companies as Standard Oil, General Electric, Amalgamated Copper, Westinghouse Electric and Manufacturing, United States Rubber, International Harvester, and United States Steel are experiencing a substantial improvement in business. Some of these report that they are now running close to their normal capacity. The voice of James J. Hill, who three years ago predicted the panic, now swells the chorus of those prophesying good times. Mr. William Rockefeller admits his inability to see 'why we should not have good times during this summer and fall.' Our imports for March of this year exceeded by $43,000,000 those for March, 1908. Secretary of the Treasury MacVeagh, addressing a gathering of New York bankers, tells of our reviving revenues, and asserts that, 'with the completion of a Tariff Bill that will satisfy the people, there is nothing in sight but reasonable, rational prosperity.' William E. Corey, president of the United States Steel Corporation, adds his testimony that the clouds are lifting. . . . It seems, however, that prosperity is not waiting patiently at our gates, but is already slipping through while Senators discuss the schedules by which she is to be admitted. The iron and steel trade, as the New York *Times* remarks, is 'our basic industry, which cannot thrive unless the country is thriving.'"

If the revival of the world's trade is near at hand, how do we stand in the matter of ability to secure the British Lion's share of it? How are we going to profit by all the arguments that we have listened to and used during the period of slackness? If we do not profit by them, then we are bound to lose, for these things have not been discussed in a corner but openly, and the foreigner can have whatever benefit he likes to glean from what has been confessed and what has been advised.

Many suggested courses have been put before us, but above and beyond all these there is a pressing need for most serious efforts to be made to bring home to the working men of this country their real responsibility. We do not despair of their being brought to see that there is a "common interest" between master and man, that there ought to be a mutual bearing of sacrifices in the interests of industry and in the interests of our people altogether.

We have recently had the privilege of conversing on this phase of our present industrial position with a gentleman of eminence and authority in the engineering world, who, by reason of his connection with large factories in England and Germany, has had exceptional opportunities for comparatively observing points of weakness and of strength of the artisans of the two countries.

While we in this country have been conspicuous for the very marked division between master and man, permitting the Trade Union idea to spread the spirit of discord and of the drawn sword, other countries in which workmen have lacked these more or less highly organised institutions, have been aided in their competition against us by a far more reasonable spirit of co-operation, as evidenced by a greater readiness on the part of the worker to adjust hours of labour and rates of pay to enable particular low-priced contracts to be secured, or to tide over periods of depression. When times are bad orders are scarce, and competing firms cut prices—all this we have seen quite enough of in this country in the electrical manufacturing industry. Internal cutting is of course bad, and only the stronger firms can outlive others at that game, if the bad times continue long enough. The weaker must go to the wall. But the point for emphasis is this: we are given to understand that in Germany at such times as these large manufacturing organisations rather than dismiss their employés, will call their representatives together, intimating, perhaps through foremen :—"Here is a certain big contract; we know we shall only be able to secure it by cutting our price down to the absolute minimum, and the only way in which that can be managed is by either reducing wages or running longer hours at the same wages." The two alternatives amount to the same thing in the long run, namely, getting more work out of the "hands" for a given figure. For such a contract the firm in question may be—indeed is—in competition with English manufacturers, who, taking everything into account, could produce as cheaply, and give a better quality, if they were only able to negotiate such a co-operative understanding as that referred to above, with their employés in English factories. Now, can this argument be brought convincingly home to the workmen of this country? We believe that they are amenable to reason, and that if only their professional agitator platform-type leaders would slink away and do some honest toil and leave the men to think the matter out for themselves, they would see that it is quite possible for them to at times materially assist the industries of their native land. Some would say that the tendency of such a course would be the permanent lengthening of working

hours or the reducing of wages—two things that are quite opposed to the spirit of this democratic age. But that could be provided against in some way we are sure, even if the spirit of the age itself were not alone a sufficient safeguard.

In the steel-makers' trade, as we stated a week or two ago, masters and employés held a conference at Swansea, and decided to bring into operation as soon as possible a general eight-hour day, enabling work to be found for an additional 1,400 men. We don't know what sacrifice the men are making in this case—no doubt there are sacrifices on both sides; the employers would hardly be expected to give their existing men a present of so many more free hours per week purely in order that others might be able to secure employment. That would not be either bargaining or business. Then again, quite recently the engineering operatives of the Ashton-under-Lyne district, in accordance with a mutual arrangement with their employers, submitted to a reduction of 1s. per week in their wages. The fact that there have at times been in these and other trades efforts to come together, show us that if left alone by the shouting strife-stirrer of the socialistic down-with-everything type, the men would readily recognise their obligations and also the wisdom of the complying with them, in the interests of the whole.

It has been represented to us by the gentleman to whom we have already referred in this article, that what is needed to enable England to keep her position in the industrial race is an extension of our present military service, or Conscription, because, on this account, the German workman is better disciplined, and, he adds, more conscientious. It is possible to much more satisfactorily arrange piece-work conditions with him, and his general tractability he attributes to the military discipline with which he is inculcated, leading in well-regulated establishments to true co-operation between worker and employer. The British workman we were told was not giving any assistance to his employer by improving either his quality or his methods, whereas in Germany, in the case of good employers, there is a much better understanding, recognising that the interests of both are the same. "To go to any workmen in this country and ask them to cut their rates because you had had to take a low price would be absurd." Turning next to the question of home life and the conditions of living generally in Germany, we were told that too many party men in England talk as though the German could live on next-to-nothing. This we were told, in modern Parliamentary language, was "absolute rot." Our informant has himself frequently passed through the dining halls of large works—halls which, as well as clothes cupboards and washing accommodation, have to be provided under the factory regulations in Germany—while the men have been at meals, and he has also seen the workmen dining in the fields close to the works with their wives and children, who have come out from home, bringing food for that purpose. He knows well, too, what the British workman eats, because he has seen him cook his food in all sorts of fashions in the works, and he asserts that, as far as food is concerned, German workmen are a great deal better off than are those of this country.

Everyone who has spent any time in the industrial centres of this country sees all too plainly that the drinking weaknesses of the British workman form perhaps the worst curse of all under which our industries labour. We are well aware that this may be met with the retort that there are sinners in positions of higher responsibility; we know that that is true, for we have seen businesses totter and fall because of drivelling inattentions of managements weakened and made incompetent by the same cause; no one need say how reprehensible that is, nor are we concerned with that point just now, but two blacks do not make a white, and when we are all of us being called upon to provide work and to pay heavier taxes, we are fully justified in asking that more efficient labour shall be provided by men with steadier hand and eye and clearer head. We have ourselves passed through factories in this country on a Monday, piloted by managers whose problems on that day are great because this, that, and the other bench or place is vacant owing to the effects of the week-end drinking bout not having been completed. They were the places of men who, when they were sober, could do such good work that they were almost indispensable, but who, until Monday afternoon or Tuesday morning came, disorganised the work of a department by their absence. No one who knows anything about the necessity for efficient organisation and operation of twentieth-century factories will accuse us of magnifying a trifle, for it is far from being a trifle, and in a well-disciplined works in Germany it would not be tolerated. The race for life to-day, both on the part of master and man, is too keen to allow of this thing continuing; the man who cannot live without his evening or week-end bout is an "inefficient," and must become increasingly so. Our informant's experience is that to see a German workman drunk is quite a rare occurrence, and we have the same testimony from other Englishmen who have travelled in the Fatherland; on the other hand, in this country "it is the rule rather than the exception, especially on Saturday when wages are paid." As an indication of the way in which the drink habit has a hold upon too large a proportion of the workers in industrial districts, we were told of a drink-shop opposite the gateway of a very large engineering and shipyard in the North, where as the men stream out on Saturdays, they find awaiting them on a shelf outside the shop hundreds of whiskies to be hurriedly lowered before they rush off to catch their trains. The enterprising licence-holder recognises the demand, and, like any other man with an eye to business, he does his utmost to meet it. But this is no exception—anybody who keeps his eyes open on Friday night or Saturday afternoon and night in London, or anywhere else for the matter of that, finds the same thing. The shipyard example was quoted to us merely as an indication of the habit which is rendering so many men inefficient, and spoiling the home lives of the men themselves and their dependants—their children whom out of sheer pity we feed free at school. And these are some of the men to whom railway companies have to grant workmen's fares, carrying them at a loss—to let them spend the difference in—well, luxuries!

The President of the Local Government Board spoke with a trumpet voice to the workmen of this country a few years ago; he knew their weakness and pointed it out, as he had also known the rottenness of much of our Poor Law and municipal administration, and pointed *that* out. Roundly enough was he abused for it of course, but there are his statements for anybody to study. Rowntree also, in his work on "Poverty," has analysed the life conditions of the poor of the city of York, and he tells us in one of his two classifications that the section that are poorer than they need be because of their wasteful expenditure, spend on the average 6s. 10d. per week upon drink out of a wage of 20s.

We are not a teetotal publication, but we make no apology for touching upon this subject, for however flippantly we may talk of it in individual cases, it is an evil tendency that is gnawing at the roots of British industry, affecting both master and man in the struggle of the times.

Another direction in which it seems to us there is plain evidence of decadence among our working classes is the tendency to allow matters of sporting interest to take first place in their lives. There is a legitimate interest that every man should take in recreative diversion according to his taste, but to render all other concerns of little account in comparison thereto displays a lamentable want of balance. We casually pass over the fact that whenever there is a strike or a falling-off in trade, there always seems to be a plethora of sixpences and shillings available for football matches, and car or train rides to reach the grounds. The zeal for sport, to the exclusion of higher things, which is characteristic of so many to-day, is well known to those who are closely concerned with industrial life. It matters not how important the work in progress in the manufactory or yard may be, if there be a football or other event arranged in the vicinity. Assume the case of a factory employing 2,000 men; if these one day absent themselves from the dinner-hour onwards, say, four or five hours per man, then 8,000 or 10,000 hours' work and output are lost to the employer, and the wages for the same time are lost to the men. Everybody knows, too, that it is practically impossible to get men to return to their work after a single Bank Holiday. Until the following Wednesday, Thursday, and

even throughout the whole week, operations have to remain at a standstill, because so many of the men want more holiday in which to squander what they ought thriftily to save for a rainy day, or for old age.

The next point arising in our very interesting and instructive interview was the bolstering up of the individual; supporting a man with false props when he ought to develop himself by walking alone. "We have got to do more than protect our workmen with such things as old age pensions; we must see where we can reform them socially." "But the trade unions teach them to be down on the masters, instead of associating them; the only manner of dealing with them seems to be to put them through some form of discipline." Among other effects of German military training is that it produces a man who, as an individual, is far cleaner in his habits, and one who takes more pride in his appearance, while his home is kept cleaner, partly because his wife is an admirable manager. "When we can find out how to make a better being of our workman, giving him more home pride and individual self-respect, we shall obtain better work, because it will raise the standard of conscientiousness."

In the German factory of our friend it is found that the skilled workman is a far more all-round man than is the British workman doing the same kind of work here. He can do a greater variety of work in a perfectly satisfactory manner, so that it is not necessary to so strictly split up the various operations. The individuality of the British workman is spoiled by restricting him to certain work and certain quantities of such work.

"The better education of the skilled German workman makes it possible for him to understand written instructions. To only the best of Englishmen can you give such instructions, but as for the others, although they read and write, they do not understand."

We are told that if, as some say, there is a larger output per man in some works in this country, it is due to the fact that the British works have generally a better machinery equipment.

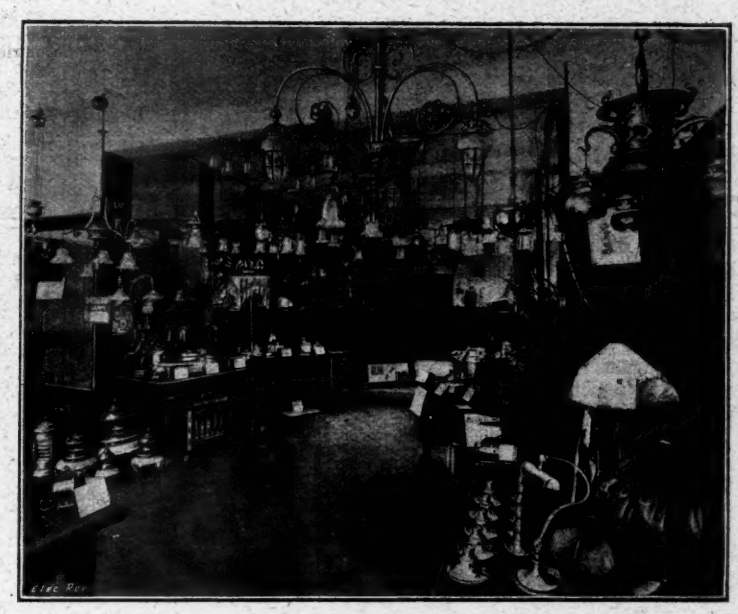
If we could remove all the disabilities that have been related in the course of this article—nothing but a Herculean and national movement could achieve it, we fear—we should be well able to maintain our supremacy in both home and export work, in spite of the additional burdens that our manufacturers are carrying. We should be better able to make electrical and general engineering work remunerative, and the more we are able to do that the better we shall be able to induce capital to become invested in the industry.

How much good the trade unions might do to their members, the masters and the community at large, by directing their energies to the amelioration of the detrimental conditions above cited! Much might be regained of any lost ground by unselfish consideration of the possibilities arising from the expected improvement in trade, dwelt upon in the first part of these notes.

The Superiority of Electric Boat Hoists.—The Admiralty have decided that in ships where the large boats, such as the steam and sailing launches and pinnaces, are hoisted out electrically, no alternative handgear is to be provided, as was the practice with steam boat hoists. The hand gear consisted of tackles manned by the ship's company, and was provided for an emergency when steam might not be available. With a steam engine it was necessary to give a reasonable amount of notice, of course, in order to give time for a "warm through," so that in the event of a ship sinking, many precious moments might be wasted, and when finally the hoists were ready, it might likely enough be too late. With the electric hoists the case is different, and the boats can be hoisted without delay.

A NEW PRESTON SHOWROOM.

Among the numerous developments which the stress of competition has forced upon the electric supplier in this country, none, we believe, will prove more useful than an attractive showroom in the right locality. Who has not smiled at the thought of the worried chief engineer, who, when deeply immersed in the preparation of Hooperian statistics for the L.G.B., is suddenly pounced on by the lady of determined character anxious to investigate an electrical flat iron. True, the picture may be somewhat overdrawn, although it illustrates approximately the state of affairs before the electricity departments awakened to the necessity of adopting ordinary commercial methods in the selling of their wares. The showroom, if it is in the right place, and has the right man in charge, is worth 50 central stations with ornamental chimneys or central offices with brass plates, as a means of getting into touch with the would-be consumer.



A Snug Showroom at Preston.

This has been fully appreciated by many people, and we have pleasure in showing, through the courtesy of the National Electric Supply Co., what has been accomplished in Preston in this way.

The National Supply Co.'s Showroom Building in Fishergate.

Our views show the fine premises which have been opened by the company in Fishergate, and which, in conjunction with the attractive literature dealing with electric lighting and motors, should materially assist to improve even the present cordial relations between the company and townspeople.

TRADE STATISTICS OF DENMARK FOR 1907.

The following figures, showing the imports into and exports from Denmark of electrical and similar goods in 1907, are taken from the recently-issued annual trade statistics; the figures for 1906 are added for purposes of comparison, and notes of any increases or decreases are given:—

N.B.—Kilog. = 2·204 lb.

IMPORTS.

	1906.	1907.	Increase or decrease.
	Half-kilog.	Half-kilog.	Half-kilog.
Rails.—			
From Sweden	—	31,000	+ 31,000
„ Germany	14,977,000	13,852,000	— 1,125,000
„ Great Britain ...	5,909,000	11,000	— 5,898,000
„ Belgium	4,363,000	3,894,000	— 469,000
„ Other countries ...	80,000	9,000	— 71,000
Total ...	25,329,000	17,797,000	— 7,532,000
Heavy Castings and Forgings, and Heavy Machinery.—			
From Norway	467,000	518,000	+ 51,000
„ Sweden	4,956,000	6,883,000	+ 1,927,000
„ Germany	40,425,000	46,463,000	+ 6,038,000
„ Holland	1,261,000	1,743,000	+ 482,000
„ Belgium	1,342,000	1,727,000	+ 385,000
„ France	608,000	486,000	— 122,000
„ Great Britain ...	12,267,000	12,580,000	+ 313,000
„ United States ...	27,162,000	36,504,000	+ 9,342,000
„ Other countries ...	2,328,000	301,000	— 2,027,000
Total ...	90,816,000	107,205,000	+ 16,389,000
Other Machinery, Instruments, &c.—			
From Norway	166,000	284,000	+ 118,000
„ Sweden	731,000	904,000	+ 173,000
„ Russia	—	81,000	+ 81,000
„ Germany	8,648,000	9,036,000	+ 388,000
„ Great Britain ...	1,674,000	1,555,000	— 119,000
„ Holland	235,000	465,000	+ 230,000
„ Belgium	111,000	113,000	+ 2,000
„ United States ...	3,414,000	3,514,000	+ 100,000
„ Other countries ...	723,000	591,000	— 132,000
Total ...	15,702,000	16,543,000	+ 841,000
Brass and Copper Wire and Nails.—			
From Sweden	18,000	28,000	+ 10,000
„ Germany	833,000	1,286,000	+ 453,000
„ Great Britain ...	530,000	908,000	+ 378,000
„ Holland	22,000	30,000	+ 8,000
„ Belgium	27,000	34,000	+ 7,000
„ France	1,000	93,000	+ 92,000
„ United States ...	305,000	210,00	— 95,000
„ Other countries ...	790,000	367,000	— 423,000
Total ...	2,526,000	2,956,000	+ 430,000
Locomotives.—	No.	No.	No.
From Germany	19	7	— 12
„ Great Britain ...	—	1	+ 1
„ France	4	—	— 4
	—	—	—
Total ...	23	8	— 15
Cables and Wire for Telegraph, Telephone, &c.—	Half-kilog.	Half-kilog.	Half-kilog.
From Germany	626,000	664,000	+ 38,000
„ Great Britain ...	19,000	159,000	+ 140,000
„ Holland	79,000	310,000	+ 231,000
„ Other countries ...	2,000	30,000	+ 28,000
Total ...	726,000	1,163,000	+ 437,000
Accumulators and Plates.—			
From Germany	189,000	547,000	+ 358,000
„ Holland	1,000	174,000	+ 173,000
„ Other countries ...	—	2,000	+ 2,000
Total ...	190,000	723,000	+ 533,000
Telegraph and Telephone Apparatus and other Electrical Apparatus.—			
From Norway	22,000	51,000	+ 29,000
„ Sweden	19,000	30,000	+ 11,000
„ Germany	994,000	1,293,000	+ 299,000
„ Great Britain ...	11,000	34,000	+ 23,000
„ Holland	2,000	18,000	+ 16,000
„ France	13,000	12,000	— 1,000
„ Other countries ...	238,000	348,000	+ 110,000
Total ...	1,299,000	1,786,000	+ 487,000

EXPORTS.

	1906.	1907.	Increase or decrease.
	Half-kilog.	Half-kilog.	Half-kilog.
Heavy Castings and Forgings and Heavy Machinery.—			
To Norway	2,441,000	3,786,000	+ 1,345,000
„ Sweden	11,578,000	15,198,000	+ 3,620,000
„ Russia	19,318,000	13,876,000	— 5,442,000
„ Germany	8,290,000	8,356,000	+ 66,000
„ Great Britain ...	3,957,000	2,272,000	— 1,685,000
„ Belgium	628,000	1,248,000	+ 620,000
„ France	96,000	418,000	+ 322,000
„ United States ...	758,000	1,361,000	+ 603,000
„ South America ...	—	1,622,000	+ 1,622,000
„ Far East	1,556,000	2,614,000	+ 1,058,000
„ Other countries ...	1,289,000	1,614,000	+ 325,000
Total ...	49,911,000	52,365,000	+ 2,454,000
Machinery, Apparatus, &c., other.—			
To Norway	300,000	178,000	— 122,000
„ Sweden	821,000	907,000	+ 86,000
„ Russia	1,408,000	1,152,000	— 256,000
„ Germany	682,000	933,000	+ 251,000
„ Great Britain ...	167,000	139,000	— 28,000
„ United States ...	210,000	341,000	+ 131,000
„ Other countries ...	805,000	435,000	— 370,000
Total ...	4,393,000	4,085,000	— 308,000
Cables and Wire for Telegraph, Telephone, &c.—			
To Sweden	6,000	168,000	+ 162,000
„ Germany	2,000	11,000	+ 9,000
„ Far East	—	29,000	+ 29,000
„ Other countries ...	1,000	2,000	+ 1,000
Total ...	9,000	210,000	+ 201,000
Accumulators and Plates.—			
To Germany	80,000	445,000	+ 365,000
„ Other countries ...	—	1,000	+ 1,000
Total ...	80,000	446,000	+ 366,000
Galvanic Elements.—			
To Norway	23,000	41,000	+ 18,000
„ Sweden	95,000	63,000	— 32,000
„ Russia	94,000	26,000	— 68,000
„ Germany	136,000	11,000	— 125,000
„ Great Britain ...	54,000	91,000	+ 37,000
„ Other countries ...	25,000	—	— 25,000
Total ...	427,000	232,000	— 195,000
Telegraph and Telephone Apparatus and other Electrical Apparatus.—			
To Sweden	33,000	122,000	+ 89,000
„ Russia	32,000	103,000	+ 71,000
„ Germany	49,000	204,000	+ 155,000
„ Belgium	—	60,000	+ 60,000
„ Far East	33,000	76,000	+ 43,000
„ Other countries ...	11,000	11,000	—
Total ...	158,000	576,000	+ 418,000

The British Association Meeting at Winnipeg.—The *Times* of Monday last contains particulars regarding the lectures and some other arrangements for the above meeting. Prof. Sir J. J. Thomson will deliver his address in the Walker Theatre on Wednesday, August 25th, at 8.30 p.m. Lectures to Winnipeg citizens are to be given as follows:—"The Chemistry of Flame," by Prof. H. B. Dixon, on August 30th; "The Pressure of Light," by Prof. J. H. Poynting, on September 1st. There will be numerous visits to railway, electrical and other works, and any of our readers who contemplate taking part in the Congress ought to communicate without delay with the secretaries at Burlington House, Piccadilly. From them hand-books of information can be obtained wherein will be found plenty of interesting material to guide the visitor. In addition to accommodation that will be available at the C.P.R. and other hotels and in private lodgings, always so well looked after by the Association's officials, we learn that there was to be completed on the first of this month a modern hostelry known as The Grange, which Mr. George Skinner will be running in Lombard Street, Winnipeg, on the European plan. From some particulars that have been sent to us, we should say that English and Continental visitors might do worse than investigate its claims for themselves.

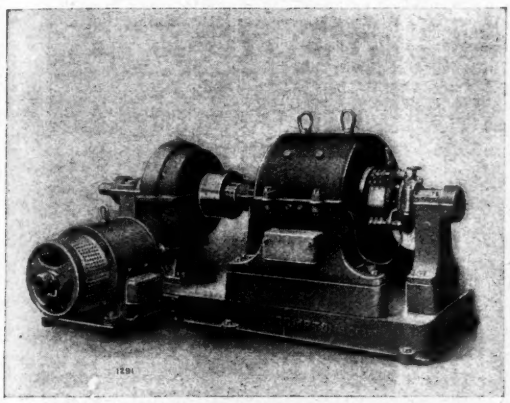
ELECTRICAL EQUIPMENT IN THE "TIMES" PRESS ROOM.

QUITE recently the *Times*, having outgrown the capacity of its existing presses, was compelled to order additional plant. Included in the latter is an Octuple press, which has been set to work, and is the highest speed machine ever installed in this country.

This machine is electrically driven, and is provided with the now well-known Kohler system of multiple push-button electrical speed control.

Four Crompton motors operate the press; two of 60 H.P. each deal with the main drive, and two smaller ones provide for turning the press round at low speed.

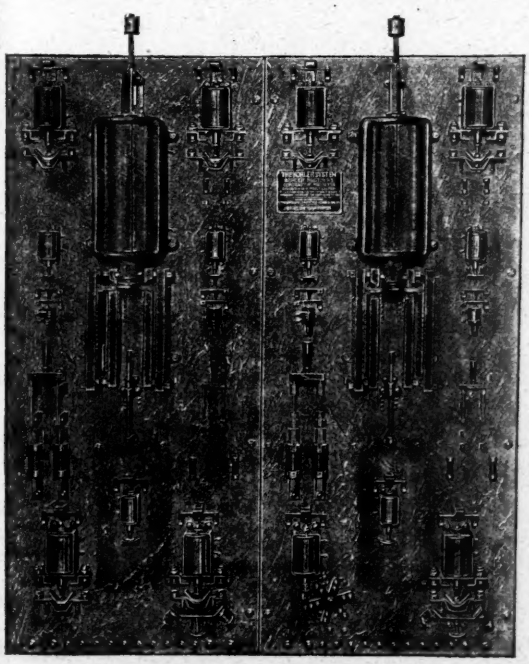
These motors are placed in pits beneath the press, to which they are geared, and are operated by a standard Kohler four-motor



CROMPTON TWO-MOTOR EQUIPMENT OPERATING ONE-HALF OF THE PRESS.

automatic solenoid controller, consisting of a panel with solenoid switches, &c., coupled up to 16 push-button stations, situated in convenient places on the press.

Each station consists of a small iron box carrying five buttons, marked respectively "on," "stop," "off," "run," "safe." The "on" button is used for starting and speed regulation from minimum to maximum; the "off" button for decreasing speed; the



KOHLER FOUR-MOTOR CONTROL PANEL.

"stop" button for stopping; and the "safe" button practically locks the machine, to safeguard against sudden starting while men are in the press, and the latter cannot be started again until the "run" button is pushed.

There are about 30 running speeds provided on the Kohler controllers, the lowest being 10 R.P.M. of the main shaft. The small motors are automatically cut out, and the large ones cut in as the speed increases. The "safe" button can also be used to prevent any increase above a desired speed, and without interfering with the ability to slow down or stop.

Any undue load would cause the press to stop automatically, the controller returning to the starting position.

The new machine referred to really consists of two presses, which can be operated independently if required.

That the Kohler system is popular in the printing world is shown by the fact that it is now in use for controlling over 600 presses.

PROCEEDINGS OF INSTITUTIONS.

Comparisons between Steam, Gas and Oil Engines.

By A. J. J. PFEIFFER, M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *London, May 13th*, 1909.)

THE following references to "oil engines" cover only those working on the Diesel principle, since only that type up to the present is constructed in sizes large enough to be considered a factor in central station design.

The principal difference between the Diesel oil engine and the ordinary gas engine lies in the fact that only the air used for combustion is compressed, the fuel being gradually injected after this compression of the air has taken place, the resultant great advantages being the elimination of the possibility of premature ignition, no sudden increase of pressure, and, therefore, less strain on the working parts.

Manufacturers of Diesel engines are now adopting the two-cycle and also the double-acting principle for large units, giving one, two or four working strokes per revolution. To obtain the two-cycle result, the principle of scavenging is resorted to by blowing fresh air at a pressure of 5 lb. into the cylinder near the end of stroke three, clearing out the waste exhaust gases, and filling the cylinder with a new charge; strokes 1, 3 and 4 of the four-cycle engine are thus combined.

The engine is started off as an air engine by compressed air stored during a previous run, the pressure being about 750 to 800 lb. per sq. in. When the engine has attained practically full speed the fuel valve is made to engage a cam, and ignition takes place. The starting-valve lever is at the same time thrown out of gear, and the engine is ready for work. This operation is carried out by one man, and is completed in from one to two minutes.

An oil-engine plant burning crude petroleum of about 18,500 B.TH.U. per lb. has a thermo-dynamic efficiency far exceeding that of a steam or gas plant, this efficiency remaining practically constant over a wide range of sizes of units; for varying loads, the following figures are a close approximation:—

½	¾	Full load.
24·8 per cent.	29·2 per cent.	30·5 per cent.

To-day there is in service a vertical 800-B.H.P. set of four-cylinder single-acting four-stroke type, having a speed of 150 R.P.M. This engine has only the cylinder and air pump water-jacketed, and it is probably the limit of size to which engines can be constructed without having recourse to water-cooling the piston, exhaust valves, &c.

For larger outputs some manufacturers are devoting themselves to the development of the two-cycle engine, the largest at present running being of 750 B.H.P., while others of equal repute are adhering to the simpler and less complicated four-cycle principle, their latest design being based on the horizontal twin-tandem double-acting type giving four working strokes per revolution, and on this design they are prepared to construct units up to 4,000 B.H.P.

As regards reliability and simplicity, this type of oil engine leaves nothing to be desired.

The engine is started up a few minutes before work is expected of it, and, in consequence, the costly stand-by losses of a steam or gas plant, especially at low load factors, are thus entirely lacking. All labour in connection with fuel handling and boiler or producer plant is done away with, and, in consequence, the wages bill of an oil-engine plant is about one-half to two thirds of that of steam or gas.

On the advice of the writer a 1,000-B.H.P. plant was installed for the Howrah system of the Calcutta Tramways Co., the largest unit being 450 B.H.P. This plant has been running for almost a year without a hitch of any kind, having passed through the period of guarantee without requiring the slightest repair.

The overload capacity of an oil engine is limited to about 15 to 20 per cent. The speed regulation can be made to come within 3 per cent. between no load and full load.

As regards parallel running, a speed variation of $\frac{1}{10}$ to $\frac{1}{100}$ can easily be obtained with a four-cylinder four-cycle single-acting engine with a small fly-wheel.

The noise of exhausts can be effectively done away with, so as to make it possible to operate a plant in the heart of a city without its becoming a nuisance.

Smoke comes into evidence when the engines operate below one-fifth to one-sixth full load, the cause being the imperfect combustion of the oil fuel.

The type of engine under consideration can burn almost any liquid fuel; but generally, and especially in Great Britain, petroleum residue from the Dutch East Indies, Texas, and

Roumania is used, while on the Continent gas oils and paraffin oils are successfully employed. Carburetted water-gas plants, of which there are a great many in Great Britain, in connection with which gas oil is used to enrich the illuminating gas, give off an oil tar as by-product which serves admirably as oil-engine fuel, having a calorific value of about 0·9 that of crude petroleum or about 16,500 B TH.U. per lb. The reliability of supply and price fluctuations may be regarded as no worse than in the case of coal.

Crude petroleum residue costs at present between 50s. and 55s. per ton at ports in England; in South America about 60s. per ton, and in Indian ports about 45s. to 50s. per ton.

Let us assume the case of a plant dealing with a maximum effective load of 1,600 KW., and consider three types of loads having the following annual load factors:—

$$\left(\frac{\text{B T.U.} \times 100}{\text{maximum load} \times 8{,}760}\right).$$

Lighting load.	Lighting and power load.	Traction load.
17·5 per cent.	33 per cent.	52 per cent.

The divisions of engine units are assumed as follows:—

Load factor 17·5 per cent.	Load factor 33 per cent.	Load factor 52 per cent.
Five 400-KW. sets (1 reserve) One 100 KW. set	Four 400-KW. sets (1 reserve) Two 200 KW. sets.	Five 400-KW. sets (1 reserve) —
2,100 KW. installed	2,000 KW. installed	2,000 KW. installed

For all the above it is assumed that 5 ((1 reserve) units are provided for both boiler and producer plants.

The following figures of capital costs are based on high-grade plants throughout:—

Steam, total per KW. installed	£24·5
Gas, total per KW.	£23 5
Oil, total per KW., from	£23 to £25

From the above it would seem that the difference of capital outlay between the three high-grade plants is but nominal. Land values have not been taken into account, as being too erratic.

TOTAL WORKS COST PER EFFECTIVE UNIT GENERATED.

(Maximum load, 1,600 KW.)

Load factor.	—	Steam. Pence per unit generated.	Gas. Pence per unit generated.	Oil. Pence per unit generated.
		At 15s. per ton	At 25s. per ton	At 60s. p'r t'n
17·5 per cent.	Fuel	0·376	0·300	0·230
	Oil, waste, water and stores	0·04	0·045	0·042
	Salaries and wages ...	0·16	0 015	0 100
	Maintenance and repairs	0·09	0·090	0·064
		—— 0 290	—— 0 285	—— 0·206
	Total	0·666	0·585	0·436
33 per cent.	Fuel	0 286	0 265	0·218
	Oil, waste, water and stores	0·035	0·040	0 036
	Salaries and wages ..	0·110	0·110	0·070
	Maintenance and repairs	0·070	0·070	0·050
		—— 0·215	—— 0 220	—— 0·156
	Total	0·501	0 485	0·374
52 per cent.	Fuel	0·247	0 243	0·212
	Oil, waste, water and stores	0 030	0·035	0 030
	Salaries and wages ...	0·085	0 080	0·054
	Maintenance and repairs	0·060	0·060	0·042
		—— 0·175	—— 0·175	—— 0 126
	Total	0 422	0·418	0·338

In the foregoing Table are tabulated details of the comparative works costs under the well recognised headings, and for the various load factors assumed above.

From figs. 1 and 2, with a given load factor and given cost of oil fuel, one can at once find the limiting price for coal, beyond which the oil-engine plant would be more economical, as, for example:—

With load factor	20 per cent.
Oil fuel	60s. per ton.
The limit of cost of coal per ton	6s. 4d. for steam. 13s. for gas.

The above results show that the internal combustion oil engine, working on the Diesel principle, possesses advantages from a technical as well as a commercial standpoint, which will make this type of prime mover a most important factor in future central station practice. Its limit of application depends primarily upon relative fuel costs, which, for Great Britain, would mean that it probably cannot compete with steam or gas engines in the immediate neighbourhood of coal centres; ; but as these cases, after all, are

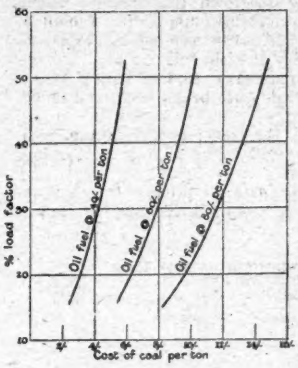


FIG. 1.—STEAM *v.* OIL.

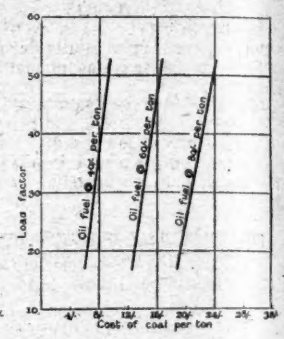


FIG. 2.—GAS *v.* OIL.

PARITY CURVES.

restricted in number, a very large field seems open for the consideration of this type of oil engine. For Colonial and foreign work, where coal costs are high, it undoubtedly possesses overwhelming advantages.

The question arises whether a Diesel plant can successfully take the place of sub-station distribution, especially in connection with very large systems where generating costs are low.

Suppose we take the case of a large distributing system in London, having an outlying central station feeding ten sub-stations; transmission by means of high-tension underground cables, each station being debited with 5 miles of duplicate cable; conversion by means of transformers and rotaries.

Maximum load on each sub station, 1,600 KW.

Loss in transmission and conversion, 14 per cent.

The total capital cost of the distributing scheme would be about £635,000.

If in connection with the 10 local Diesel plants we allow £5 per KW. installed as the value of land, the total capital involved, based on two-cycle engines, would be £560,000, as against £635,000 for the central-station sub-station scheme.

The following table shows the difference in total operating expenditure in pence per effective unit, including capital charges (management, rates and taxes, &c., not included).

Local station load factor:—	17·5 per cent.	33 per cent.	52 per cent.
A. Central-station sub-station—			
1. Works cost—coal at 14s. ...	0·580	0·447	0 376
2. Interest and depreciation ...	0·536	0 280	0·180
Total	1·116	0 727	0·556
B. Diesel plant—			
1. Works cost—oil at 50s. ...	0·396	0·338	0 303
2. Interest and depreciation ...	0·500	0·267	0·169
Total	0·896	0·605	0·472
Difference in favour of Diesel plants	0 220d.	0·122d	0 084d.

Judging by these results it is evident that under the above assumptions the local Diesel plants can be operated cheaper than a system with a large outlying central station distributing power by means of converting sub-stations.

Electricity Works and Refuse Destructors.

AT the last meeting of the INSTITUTION OF ELECTRICAL ENGINEERS (DUBLIN), on May 13th, MR. J. A. ROBERTSON'S paper was discussed (ELECTRICAL REVIEW, May 21st, p. 835).

MR. G. F. PILDITCH, who opened the discussion, said that there was bound to be trouble due to dust entering the engine room; it might not be sufficient to lead to hot bearings, &c., but still it was to a certain extent a nuisance. The cost of repairs when a destructor was generating steam was necessarily higher, owing to the expansion and contraction which ensued consequent upon the irregular burning of the fuel, owing to the irregular load on an ordinary lighting station; further, the steam supply was irregular owing to the variable calorific value of the refuse. Nevertheless, a lot of good could be got out of a destructor provided that the steam could be used as generated. At Rathmines they had two sets of units, divided into three cells each, and one water-tube boiler. During the official tests they obtained the following results:— Each cell consumed about 12 tons during the 24 hours, or 36 tons per day. Water evaporated from and at 212° was 1·78 lb. per lb.

of refuse, with a draught averaging 2·9 in., air was admitted at 65° F., and left the regenerator at 265° F. Under running conditions they evaporated 1·25 lb. water "from and at" per lb. of refuse, and obtained 35-40 units per ton, after allowing for steam utilised in driving fans, clinker crushing plant, &c.; this, he thought, was a very fair result. By-passing the gases should be avoided if possible. The conditions in Rathmines were somewhat exceptional, and they had installed a 2,000-A.H. battery because they had a large street lighting load; thus they were now able to save an extra shift of men during the winter. They had a clinker crushing plant at the back of the works, but in windy weather considerable grit found its way into the engine room. He used the back-firing system, and found it very satisfactory. Originally he used fan draught only, but soon found that the fire bars burnt away, and he had since introduced a small steam jet under the bars, which served to keep them cool, and, at the same time, they got a better clinker. At Rathmines they paid the sanitary department £450 per annum for steam.

Mr. S. L. R. Price thought that authorities owning destructors should support them better; for instance, the clinker produced should be used for concrete blocks, footpaths, &c. At Pembroke they had tried to sell it to builders, but it had been condemned by architects owing to the presence of metallic veins, and it now cost them 4·4d. per ton for carting away. He thought that the tub system of dumping refuse on to the fire was not an efficient one, as it tended to blacken the fires and temporarily reduce the temperature; he considered hand firing much more efficient for that reason. When originally installed, their destructor was fitted with steam jets, but he found that the jets required 30 to 40 per cent. of the steam generated by the destructor. They next put in a "Sirocco" fan without steam jets, but the stokers struck, owing to the hardness of the clinker and the difficulty of removing it. Now they used steam throughout the day, and in the evening put on the fan to increase the rate of combustion. He had had a great deal of trouble owing to the buckling of dampers, and had tried a water-cooled damper, with very satisfactory results. In conclusion, Mr. Price expressed the opinion that an electricity department should pay nothing to the sanitary department for the use of the steam, as the destructor had the benefit of skilled management, and was worked more efficiently than it would be otherwise.

Mr. S. T. Land had had some experience of a Beaman & Deas top-feed destructor, and although the refuse was allowed to "stew" on top, it did not prove particularly objectionable, and the results obtained were very good. He disagreed with the author's statement that the calorific value of refuse was better in mining districts; at Canterbury the value was far better than at Wakefield. There was no doubt that a great deal of dust did reach the engine room, and there was no satisfactory way of excluding it; but it caused no real trouble, and only meant a little more energy on the part of the men attending to the plant. He agreed with Mr. Price that the method of charging the furnaces advocated by the author was not good. A series of small arches arranged parallel to each other did mix the gases more thoroughly and ensure complete combustion; at Rathmines they obtained 13·9 per cent. of CO_2, which proved that point. He thought a combination of steam jets and fan draught produced the most economical results, and that it did not matter very much what class of clinker was produced, as usually it could not be sold.

Mr. T. Tomlinson was very emphatic as to the necessity of the destructor being worked on the right lines, to destroy refuse sanitarily *first*, and if there was any surplus power afterwards, well and good.

Mr. N. Hosgood said that the ordinary house-to-house collection of refuse was about as unsanitary a system as one could well imagine. The sanitary authorities should supply householders with strong combustible bags to put the refuse in; it could then be removed to the destructor and burnt without opening. The roofs of destructor houses, containing as they did innumerable pockets, were ideal places for the cultivation of microbes; all such places should be filled in and corners carefully rounded off. The ideal method of destroying refuse was in the kitchen range at home, and it was astonishing what could be done in that respect. Mr. Hosgood concluded by entering a plea for the comfort of the men employed in the unpleasant task of attending the destructors; it was quite common to see men standing with their faces to the hot fires and cold winds blowing on their backs. At Pembroke they had covered in the front of the destructor house with sliding doors, and since then there had been very much less sickness among the men employed.

We have received the following communication relating to this subject, in reply to that of Mr. Ashton Bremner (p. 836):—

It seems to me that Mr. Ashton Bremner's letter in your issue of the 21st ult. ought not to go entirely unanswered. His extreme anxiety to prove the Horsfall destructor at Greenock inferior to the Heenan & Froude destructor at Burslem has led him into error, and some of the remarks he makes might have been exceedingly injurious to my firm, if they had been put forward by a greater authority with less bias.

Mr. Bremner's sweeping condemnation of all that has been done at Greenock is not confined to the destructor however, and it is some comfort to me to know that he considers a Green economiser an "expensive and inefficient appendage."

It is also interesting to be told that his very strong opinions have been formed without his having seen the installation at Greenock.

Mr. Bremner's first error occurs in speaking of "excessive capital cost" where he gives the number of cells at Greenock as *four*, instead of *six*. The capacity of the plant at Burslem is about 11 cwt. per cell per hour, and at Greenock *one ton* per cell per hour.

The amount burned per sq. ft. of grate per hour is 103 lb. at Greenock, and 82 lb. at Burslem. The capital cost per ton of capacity per day at Greenock is about 16 per cent. higher than at Burslem, if the Burslem figure of £4,525 includes half the cost of the site and of the chimney, and the whole cost of the destructor building (about which I should like to be informed). The saving in labour is, however, about 40 per cent per annum.

Mr. Bremner gives his figure at 10d. per ton, and Mr. Robertson, 1s. 1½d. per ton. Mr. Bremner's figure works out at £325 per annum for 7,800 tons burned. This is just about sufficient to pay two stokers in two shifts, and evidently includes stokers' wages alone.

I have obtained from Mr. Robertson the following analysis of the labour costs at Greenock:—

Wages for week ended February 13th, 1909.
Refuse burned = 393 tons.

	No. of men.	Wages.	Per ton.
Supervision	2	£3 12 0	2¼d.
Check weighmen...	2	£2 4 0	1¼d.
Stokers	4	£6 10 5	4d.
Cranemen	3	£3 5 4	2d.
Clinkermen (crushing and wheeling clinker for sale)	3	£4 5 4	2¼d.
Temporary labourers (loading clinker in wagons)	3	16 10	½d.
Pitman	1	£1 8 3	1d.
	18	£22 2 2	1s. 1½d.*

* The extra ½d. appears to be for temporary labour when this analysis was made.

It will be seen that the figures comparable with those given for Burslem, viz., stokers, 4d., and cranemen 2d. per ton—give a total of 6d. per ton for the furnace work, as against 10·1. at Burslem.

Mr. Robertson's figure for supervision includes one shift engineer (who has charge of the electricity works as well).

With regard to the very high evaporation given for Burslem, viz., 2·16 lb. per lb. of refuse from and at 212° F., I venture to point out that as town refuse is one-third water and one-third incombustible clinker, the evaporative value of the combustible portion of the refuse at Burslem must be 2·16 × 3 = 6·48 lb. per lb. This compares fairly well with coal. But Mr. Robertson, with his modest evaporation of 1·41 lb. per lb., gets 97 units of electricity per ton on test, and 67 units all the year round, after charging the destructor with all stand-by losses. Mr. Bremner claims to get almost exactly the same result on an average, viz., 70 units per ton. He does not say how he arrives at this figure or how he draws the line between the steam raised by coal and that raised by muck. Much depends on that. But assuming the figure of 70 units to be exact and comparable with the Greenock figure of 67 units, and after making all possible allowances for larger units and larger condensing sets at Greenock, it is somewhat remarkable that there should be a difference in the actual average product of only 3 units per ton.

The "rotten cabbage stalks and stinking fish" (I am quoting another eminent electrical engineer) must have been somewhat above the average on the day of the test.

It is obvious that the percentage of clinker given for Burslem does not include the ash from underneath the grates. This was included at Greenock.

Mr. Bremner is entitled to his opinion that there is no advantage in mechanical charging from a sanitary point of view. It is not, so far as I know, shared by any engineer who has inspected both systems at work.

The "half-cooked gases" mentioned by Mr. Bremner exist only in his imagination. They do not put forth gases or anything else half-cooked at the Greenock destructor. The minimum temperatures in the flues at Greenock are a long way above those required for complete cremation of the gases, and no complaints of any kind have been received.

Mr. Bremner speaks of the repairs bill as heavy, but he has evidently overlooked Mr. Robertson's explanation of this item.

Mr. Bremner, in the same sentence in which he states that he is familiar with the type of plant at Greenock (although he has not seen it), remarks that "the forming of large openings in the crown of the arches must result in constructional weaknesses." He has been badly coached on this point. There are no openings in the crown or any other part of the arches.

He is equally badly informed about the high air pressure forming "volcanoes" in the fire.

His criticism of the "Horsfall" patent side boxes as air heaters shows that he is not aware of their chief object, which is the protection of the furnace brickwork from damage by the clinker. He considers our method "crude and inefficient," but this is quite excusable considering that he was not aware of the chief purpose for which the boxes were intended.

Pipe air heaters in the flues are by no means peculiar to Burslem, but are used by practically all makers. It was not considered advisable to have them in addition to the Green economisers at Greenock.

With regard to inrushes of cold air when clinkering or charging, Mr. Bremner says that on the Burslem system such inrushes are easily controlled by regulating the dampers, and a state of pressure equilibrium is maintained. Are his dampers adjusted every time the doors are opened, or is he working with no natural draught at

all? Several destructors have been built with outlet dampers to each cell connected by chains with the clinker doors, but this device disappeared many years ago when high temperatures came into fashion.

I have no wish to depreciate the results obtained at Burslem, which are undoubtedly first-class, but I am bound to point out that destructor test figures can be made very misleading when handled by a partisan.

G. Watson, *Managing Director*,
Horsfall Destructor Co., Ltd

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

DENMARK.—Invoices and consignment notes should state the gross weight of packages and the net weight of contents, which should be fully described and the country of origin stated. When various descriptions of merchandise are packed together the net weight of each class should be stated separately.

The following duties are payable on electrical and similar goods. 100 öre = 1 krone = 1s. 1½d.; kg. = 2·204 lb.

	Öre per kg.
Celluloid articles	70
India-rubber articles not separately mentioned	70
Lamp shades of opal glass if furnished with fittings, &c., of metal or other materials	20
India-rubber and gutta-percha ribbons, blocks, edging, sheets and disks, &c.	16
Pitch, tar, asphalt, &c.	free
Astronomical, surgical, mathematical, physical and similar instruments	70
Cement, lime, asbestos, &c.	free
Porcelain and biscuit ware	70
Roofing tiles	free
Earthenware pipes and conduits	free
Coal	3 öre per 100 kg.
Electric machines, dynamos and electromotors	7½% ad val.
Other machinery	5% ad val.
Parts of machines	5% ad val.
Engine packing and insulating materials, of various components	10 öre per kg.
Ditto, other kinds	according to description
Metals in pigs, blocks, bars, plates, rods, not having undergone any further process than smelting	free
Wire having paper textile or other material spun round, woven in or twisted round it, including wire for electric current, or cables	7½% ad val.
Plates and sheets of iron, even, channelled or curved, corrugated pipes, rails and sleepers, constructional iron, axles, tires, drawn tubes	free
	Öre per kg.
The above if punched or bored	1½
„ riveted together	3
Wire not elsewhere mentioned, less than 5 mm. thick	3
„ „ „ other	2
Chandeliers and candelabra if nickelled, bronzed, &c.	20
Common wrought and cast articles of iron not mentioned in the Tariff	10
Roughly-drawn pipes of lead	4
Rolled wire of lead, tin, zinc, copper, brass, &c.	free.
Other wire of copper, brass or yellow metal	8
Copper plates and sheets of copper or brass	10
Railway carriages	7½% ad val.
Locomotives and other railway or tramway rolling-stock	5% „
Goods not specially mentioned in the Tariff	7½% „

NEW PATENTS APPLIED FOR, 1909.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

12,156. "Improved arc lamp." T. Garnett. May 24th.

12,195. "Improvements in electric alarm and regulating clocks." W. Rausch. May 24th. (Complete.)

12,203. "Improvements relating to pocket magnetic compasses." C. W. Somerset and A. F. C. Bentley. May 24th.

12,254. "Improvements in and relating to third rails." C. A. Bluhm. May 24th. (Complete.)

12,288. "Device for starting and cutting out electric motors." Z. Frankenthal. (Date applied for under Sec. 91 of the Act, June 1st, 1908, being date of application in Germany.) May 24th. (Complete.)

12,286. "Improvements in magneto-electric ignition apparatus for use in connection with the ignition systems of internal combustion engines." R. F. Hall. May 25th.

12,296. "Improved method of fixing terminals or connections in carbon rods or blocks." J. Dunkley. May 25th.

12,304. "Improvement in connection with electric light signs." H. I. Palmer. May 25th.

12,308 "Improvements in the metal sheathing of electric conductors." C. Curwen. May 25th.

12,335. "Improvements in electric switches." W. D. R. MacDiarmid and E. B. Bates. May 25th. (Complete.)

12,344. "Improvements in switch-throwing devices." P. H. Petersen. (Date applied for under Sec. 91 of the Act, September 19th, 1908, being date of application in United States). May 25th. (Complete.)

12,345. "Controller for preventing the speed of motor vehicles from exceeding a predetermined maximum when such vehicles are fitted with electrical ignition or driven by electricity." W. Burgess and F. E. Davies. May 25th. (Complete.)

12,347. "New or improved incandescent electric lamp." A. A. A. Zimmer and R. R. Needham. May 25th.

12,348. "Improvements in incandescent electric lamps." A. A. A. Zimmer and R. R. Needham. May 25th.

12,387. "Thermostat which closes an electric circuit on a sudden rise or fall in temperature." A. G. Horne and J. Paul. May 26th.

12,395. "Improvements in or connected with electric switch operating mechanism." Electric Control, Ltd., C. Macmillan and W. P. Dryer. May 26th.

12,396. "Improvements in and connected with carbon brush-holders for electric switches." Electric Control, Ltd., C. Macmillan and W. P. Dryer. May 26th.

12,430. "Improved electrical apparatus for operating advertising signs." M. A. J. Harper. May 26th.

12,442. "Improved combined section insulator and double-action quick-break switch for electric trolley conductors." W. G. Hamilton. May 26th. (Complete.)

12,450. "Improvements in or relating to hot water and electric supply systems" R. Herzfeld. May 26th.

12,452. "Improvements in electric plugs" H. J. Fisher. May 26th.

12,469. "Improvements in apparatus for electro-plating tubes and rods." S. O. Cowper-Coles. May 26th.

12,473. "Multiplex transmitter and circuit for same." G. R. Webb May 26th. (Complete.)

12,474. "Improvements in and relating to the manufacture of filaments for incandescence electric lamps." E. R. Grote. May 26th.

12,477. "Improvements in electric insulators." Bullers, Ltd., and H. Dagnall. May 26th.

12,481. "Improved automatic cut-in and cut-out device for electric circuits." E. Dewhurst and A. A. S. Roscoe. May 26th.

12,482. "Improvements connected with electric plating apparatus." R. Walker and W. C. Pinson (trading as The British Brake Co.). May 26th. (Complete.)

12,501. "Improvement in electro-magnets for lifting purposes and the like." H. T. Westwood and C. W. Dawson. May 27th.

12,507. "Improvements in or relating to electrodes for electric furnaces." M. Ruthenburg. May 27th.

12,541. "Improvements relating to the electric lighting of motor-vehicles and the like." H. Lucas and G. H. Jackson. May 27th.

12,562. "Electrical heating device." G. Cooper, F. C. Sharp and T. A. Stevens. May 27th. (Complete.)

12,569. "Improvements in the manufacture of metallic-filaments for incandescence electric lamps." C. H. Stearn and C. F. Topham. May 27th.

12,585. "Improvements in fuse switches." A. L. Weekes. May 27th.

12,591. "Improvements in and relating to lamp-holders and the like." Drake & Gorham, Ltd., and S. G. Jones. May 27th.

12,607. "Improvement in and relating to trolley heads for electrical tramcars." W. L. Smith and W. Watson, Jun. May 28th.

12,685. "Improvements in or relating to the generation, transmission and distribution of electricity." M. B. Field and Ferranti, Ltd. May 28th.

12,686. "Improvements in and relating to the manufacture of filaments for electric lamps." A. Bourdos. May 28th.

12,689. "Improvements in and relating to electric meters." British Thomson-Houston Co., Ltd., J. Gray and F. Holden. May 29th.

12,709. "Improvements in electrodes." Electrolytic Alkali Co., Ltd., C. C. Connor and J. W. Stubbs. May 29th.

12,745. "Process for the manufacture of guaiacolsulphonic acid and its salt." J. Wetter. (J. Hoffman-la Roche & Co., Switzerland.) May 29th. (Complete.)

12,774. "Improvements in or relating to brush holders for dynamo-electric machines." M. A. McLean. May 29th.

12,776. "Improvements relating to metallic-filament lamps." M. Graetz. May 29th. (Complete.)

12,782. "Improvements in electric polyphase commutator machines." Allmanna Svenska Elektriska Aktiebolaget. (Application for Patent of Addition to No. 24,581/08). May 29th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Method of Regulating Electric Motors. C. H. Prott. 4,950. March 4th.

Electric Motor Control Systems. A. H. Jackson. 7,335. April 2nd.

Switches for Electrical Circuits. J. H. Hilliard and C. E. Parsons. 9,756. May 5th.

Automatic Cut-Out Apparatus for Electrical Circuits. Felten & Guilleaume Lahmeyerwerke Akt.-Ges. 9,844. May 6th. (Date applied for under International Convention, May 6th, 1907.)

Accumulators or Secondary Batteries. A. J. Boult. (Schlesische Akkumulatoren-Werke Akt.-Ges.) 10,037. May 8th.

Apparatus for Electrically Igniting Miners' Safety Lamps in Mines. J. C. Best. 10,838. May 19th.

Electric Distributing Systems. British Thomson-Houston Co. and E. B. Wedmore. 11,634. May 28th.

Closure Devices for Telephone Mouthpieces. H. A. Cutmore. 12,346 June 6th.

Means for Electrically Transmitting and Controlling Motive Power. C. H. Vidal and W. E. Vidal. 14,312. July 6th.

Process for the Production of Tungsten Filaments for Electric Incandescent Lamps. Westinghouse Metal-Filament Lamp Co. (Westinghouse Metallfaden Gluhlampen Fabric Ges.) 14,942. July 14th.

Electromagnetically-Controlled Switches. British Thomson-Houston Co. (General Electric Co., United States.) 14,967. July 14th.

Electric Lamps, Adapters and the like. F. Wilkins. 15,020. July 15th. (Cognate Application 28,294/08.)